the OIL AND GAS JOURNAL
PUBLISHED WEEKLY SEPTEMBER 26, 1960

# More from drilling-rig engines

p.123

Surplus rigs keep pressure on drillers ▶ 99

First "alcohol flood" gets under way ▶ 104

New tubular goods will cut drilling costs ▶ 108

Boosting octanes by reforming cat gasoline ▶ 112

HIGHEST SAFETY FACTOR—up to 1,500 psi shock load

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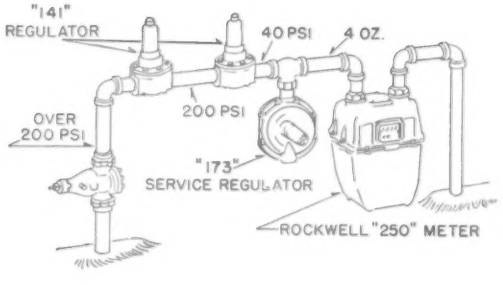


There are many opportunities to sell gas direct from high pressure lines. Farm tap service is one. Irrigation service is becoming equally important. The use of two "141" regulators for the primary cut provides a wide margin of safety while eliminating stress, valve abrasion and wire cutting.

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another fine product by

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OIL AND GAS JOURNAL
Vol. 58, No. 39

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## ANNUAL DRILLING NUMBER


MORE FROM DRILLING-RIG ENGINES ..... 123

*By Ed McGhee*

**The drilling contractor spends more money each day to keep his rig engines running than he does for any other item except labor. And the cost of routine maintenance, repairs, and depreciation represents a substantial part of this expense. Thus, no contractor can afford a casual approach when buying and operating his power plant.**

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*By Ed McGhee and Carl Hoot*

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More U. S. Contractors Throw in the Sponge ..... 150

*By Robert B. Bizal*

**Contractors have had an 8% dropout this year and rig ownership has slipped another 5½%. Since 1957, the number of rotary drilling firms has dropped 23.5% and rig ownership has dropped more than 13.5%.**

Active-Field Drilling Report ..... 153

*By Peter B. Bike*

**Kentucky continues its fast pace of drilling. The Swanson River area in Alaska also is active. Northwest Oklahoma, the Four Corners area, South Texas, and Louisiana are areas where success ratio is high enough to warrant the investment.**


## TECHNOLOGY—OPERATION


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*By Joseph Zaba*

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*By James P. O'Donnell*

**This consolidated underground system will be installed in the Chicago-O'Hare International Airport to handle the vast quantity of fuel expected to be required there 5 years hence.**

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**How complexity of a refinery affects costs of processing.**

Surfactant Slugs in Water Flooding ..... 220

*By Carl E. Johnson, Jr.*

**Objective is to maintain a relatively high concentration of surface-active material at the flood front. Here is a mathematical method for finding the amount of surfactant needed, and the best initial concentration to use.**

Pipeline Construction Report ..... 228

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Sept. 26, 1960

Drilling industry may get out of trouble in 2 or 3 years:

Contractors and supply men say the situation then will be this: Rigs fewer in number but bigger and faster, and they will be owned by larger, better financed, and experienced operators (p. 99)*.

Journal's new drilling census shows 933 contractors now are doing business in the U. S., 8% below the 1,018 in business last year. They owned 3,397 rigs, 5½% below last year (p. 150).

Of the 3,397 available rigs only 1,732 have been working regularly this year. But many oil men say the number of workable rigs is vastly overstated. Many of them are junk, some too old to drill, others stripped of vital components to keep other rigs running.

▼ ▼ ▼

New equipment aimed at lowering costs was displayed to mechanical engineers at New Orleans meeting. Some items:

...Oilwell tubing joint resistant to high-pressure leaks but costing little more than API couplings.

...Aluminum drill pipe ready for selling this year.

...Thin-wall pipe cheaper but just as reliable as the standard line pipe in many uses.

...Bimetallic pipe made of standard steel tubes with a lining of corrosion-resistant metal (p. 108).

▼ ▼ ▼

New drilling-production records so far this year:

...Illinois—Humble drills to 8,613 ft. for depth record at 1 Weaber-Horn unit in Fayette County. Texaco got deepest producer at 16 Silverman in Wayne County in Devonian at 5,331 ft.

...North Dakota—Amerada's 1 Antelope in McKenzie County is state's deepest hole at 15,135 ft. Production was found up hole at 12,000 ft. in Silurian.

...Arkansas—Austral Oil 1 International Paper Co. in Lafayette County got production at record 11,025-ft. depth in the Smackover Jurassic.

---

*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

...Texas—Atlantic Refining Co. has state's deepest producer at 1 Kelly in Pecos County which found gas in the Montoya Ordovician at 16,680 ft. after drilling to 19,696 ft.

▼ ▼ ▼

Florida may have a new oil discovery at last.

Humble is preparing to set 7-in. production casing in its 1 Miles Collier wildcat in Southwest Florida and is hopeful it's a producer. Total depth is 11,737 ft.

California-Coastal, meanwhile, plans to spud its 1 State Lease 224-B well in Lee County, Florida, this week.

Los Angeles' town-lot fields are assured further development after city approves 11 new drilling districts. The action adds 1,506 acres to the West Los Angeles drilling play of Signal and Richfield.

Signal may develop the districts from drilling sites on Hillcrest Country Club and Rancho Park golf course (p. 117).

Texaco has started developing the highest-priced offshore lease in oil history, Parcel D, a 3,840-acre tract off Santa Barbara County, Calif.

Texaco, Monterey, and Newmont paid $23.7 million or $6,175 an acre for the acreage in July 1958. Texaco, the operator, is drilling below 2,172 ft. from the platform, "Helen", which is 1½ miles offshore in 95 ft. of water.

Parcel D has been a tight-hole operation, but Texaco reportedly drilled two core holes from a drilling ship which flowed 1,393 bbl. daily. The current well is the first to be drilled from the permanent platform.

▼ ▼ ▼

First major test of an alcohol flood has been kicked off in Pennsylvania's Bradford field by South Penn Oil.

Total of 27,000 bbl. of isopropyl alcohol slugs will be injected into a five-spot flood unit at rate of 100 bbl. daily. The alcohol is miscible both in oil and water and reportedly acts like a piston in driving the oil forward.

Test will be tertiary recovery at Bradford and has attracted world-wide interest because of vast potential (p. 104).

Fire floods are proving as effective and economic as water flooding and miscible phase in fields with lighter gravity crudes.

This opens a new area for use of thermal recovery—it now is used chiefly in fields of low gravity crude.

Other data on fire floods: Recovery ratios up to 75% of oil in place are possible. Fractured formations are no deterrent. Most producing formations and completion techniques lend themselves to thermal programs (p. 113).

California oil operators are breathing a little easier now that Gov. Edmound G. Brown has declared he will not ask for any new taxes during the 1961 legislative session.

Brown backed a 2% severance tax on oil and gas production in 1959. However, the threat of a tax remains. Agents of the state Finance Department have been talking with county assessors about a severance tax. The assessors opposed the 1959 legislation. It's doubtful any serious effort will be made to push for a tax in 1961, however.

▼ ▼ ▼

Tomorrow's high-octane gasoline can be made in today's processing units.

Sun Oil engineers, estimating that leaded research octane number will move up to 105 in this decade, have found this processing route: Reform a heavy cat-cracked gasoline fraction.

Advantage of the heavier cut is its lack of olefins which allows a higher octane gasoline (p. 112).

▼ ▼ ▼

The Washington beat:

Look for Interior to consider tightening crude-oil import program.

The reason: It notes that domestic crude production is falling about 3,000-bbl. daily behind the base year—1957. Meanwhile, there have been increases in condensates and gas liquids, and in product and crude shipments from District 5 and from Puerto Rico. Residual-fuel imports enter picture too.

All in all, while consumption of oil products has risen, demand for crude has stayed static. And the goal of the control program is to strengthen domestic producer operations. That is why a reduction in crude imports will be considered.

Decision will be made in top administration circles, since a change in president's proclamation probably will be necessary.

Gulf Oil's court challenge of residual-fuel program has been postponed from September 28 to December.

Gulf asked the delay because upcoming resid-control changes may make some points of its case moot. Interior's proposed changes probably will be published this week.

Other Washington notes: Look for Phillips case decision any day now, maybe even by the time this reaches you... OCDM is meeting today with several oil company agents to discuss further proposed residual-fuel price-reporting form... Industry objections to the report are growing...OCDM ruling on asphaltic crudes is still several weeks away.

# Market Memo

Sept. 26, 1960

In deals now developing, look for:

...Phillips to enter Maryland-Delaware-Washington market about November 1 when terminaling facilities are completed. Phillips service station already is under construction in the District of Columbia.

...Murphy Corp., long on crude and with no refining, to make processing deals with Cities Service, Crown Central, Delhi-Taylor in move eventually to supply newly acquired Spur and National Petroleum outlets.

...Signal to pay a reported $8.5-million cash for Supertest Oil Co., Tampa, Fla. Involved are 60-million gallons of distribution annually, 120 fee-owned stations, 60 dealer accounts.

Interior Department in Washington will announce later today its monthly report on residual-fuel imports, including following data:

...Resid imports to Gulf and East Coast averaged 251,800 bbl. daily in August, compared with 263,265 bbl. daily in July and 312,000 bbl. daily in August last year.

...Importers, to fill third-quarter quota, will be able to bring in an average of about 235,000 bbl. daily in September.

...Bonded resid stocks were 11,428,595 bbl. at end of August, an increase of 3,130,403 bbl. over the previous month and 7,493,174 bbl. over the August 1959 level.

A quick rundown on the markets:

...Gulf coast—posted prices steady at 11.25 cents for 92-RON gasoline and 8.25 cents for No. 2. Five cargoes of spot gasoline are available at posted prices.

...Mid-Continent—gasoline demand good along Great Lakes pipeline but prices are easier at 12.25 to 12.50 for 91-RON and 15.25 cents for 99-RON. No. 1 gets 10 cents and No. 2 at 8 cents with both firmly held awaiting price rises.

...Chicago area—gasoline prices are firmer at 12.625 cents for 92-RON and 15 cents for 99-RON. Early fall demand needed for middle distillates now at 10.25 and 9.50.

...Mississippi mid-river—disturbingly inactive. Inquiries coming mostly from bargain hunters. Current price basis for gasoline is Gulf Coast low of 11.25 cents for 92-RON. No. 2 is not being pushed, but is held for 8.5 cents.

...General—refiners reluctant to consider discounts on products largely due to general price firmness and the scarcity of crude. Continued low crude allowables appear to be only effective force to reduce excess crude runs and attendant stackup of products.

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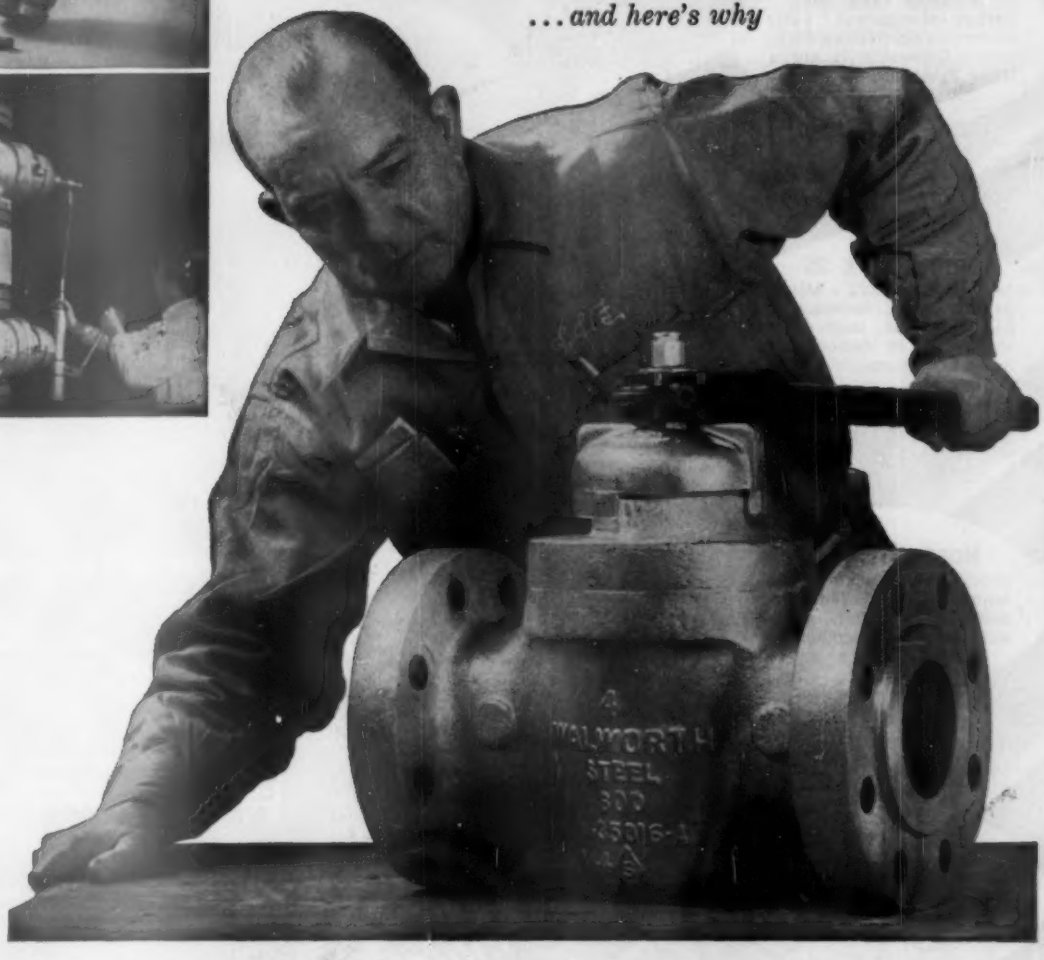


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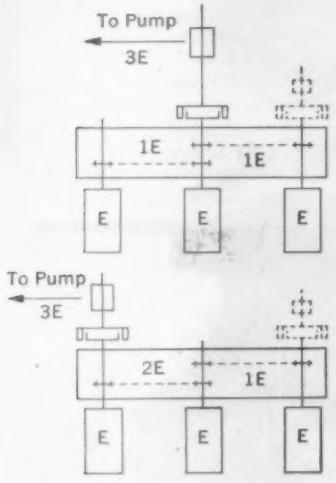
# How to put power to your pumps!




**Did you know** that the location of the pump take-off on your rig drive can reduce the load by 50% on the critical compound chain without sacrificing pump power?

The diagram shows how driving the pump from the second shaft of a three-engine compound imposes the output of only *one* engine on each compound chain. Driving the pump from the third shaft imposes the output of *two* engines on the rear compounding chain.

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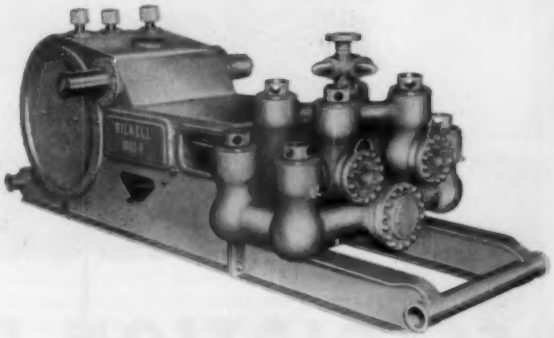
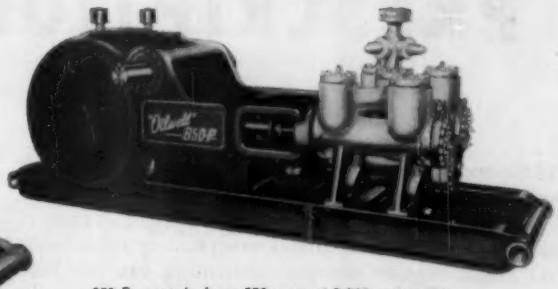
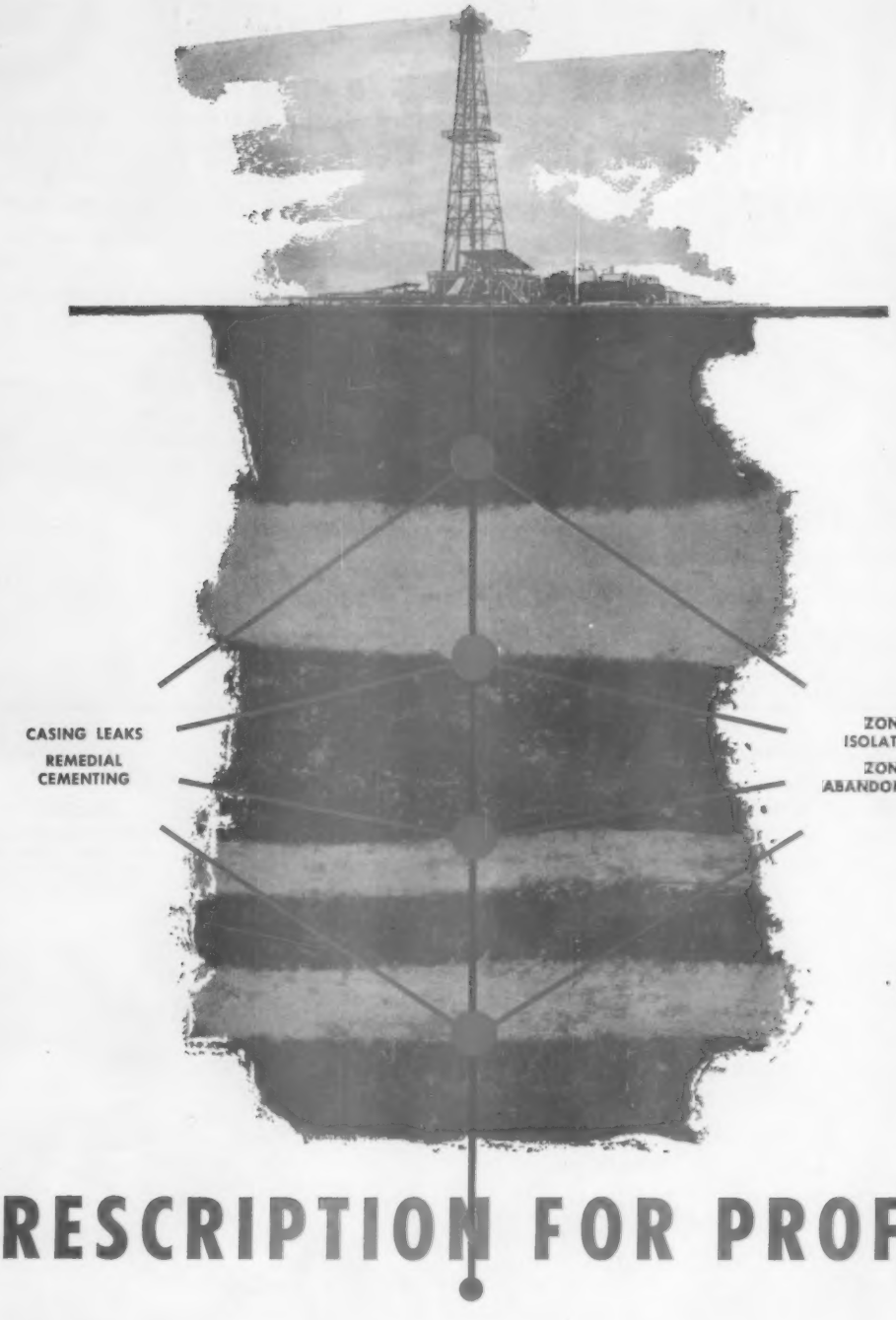


*1000-P* range is from 396 gpm at 3,660 psi to 870 gpm at 1,675 psi with 1,000 input horsepower.

*700-P* range is from 374 gpm at 2,725 psi to 796 gpm at 1,280 psi with 700 input horsepower.



*850-P* range is from 352 gpm at 3,500 psi to 774 gpm at 1,600 psi with 850 input horsepower.

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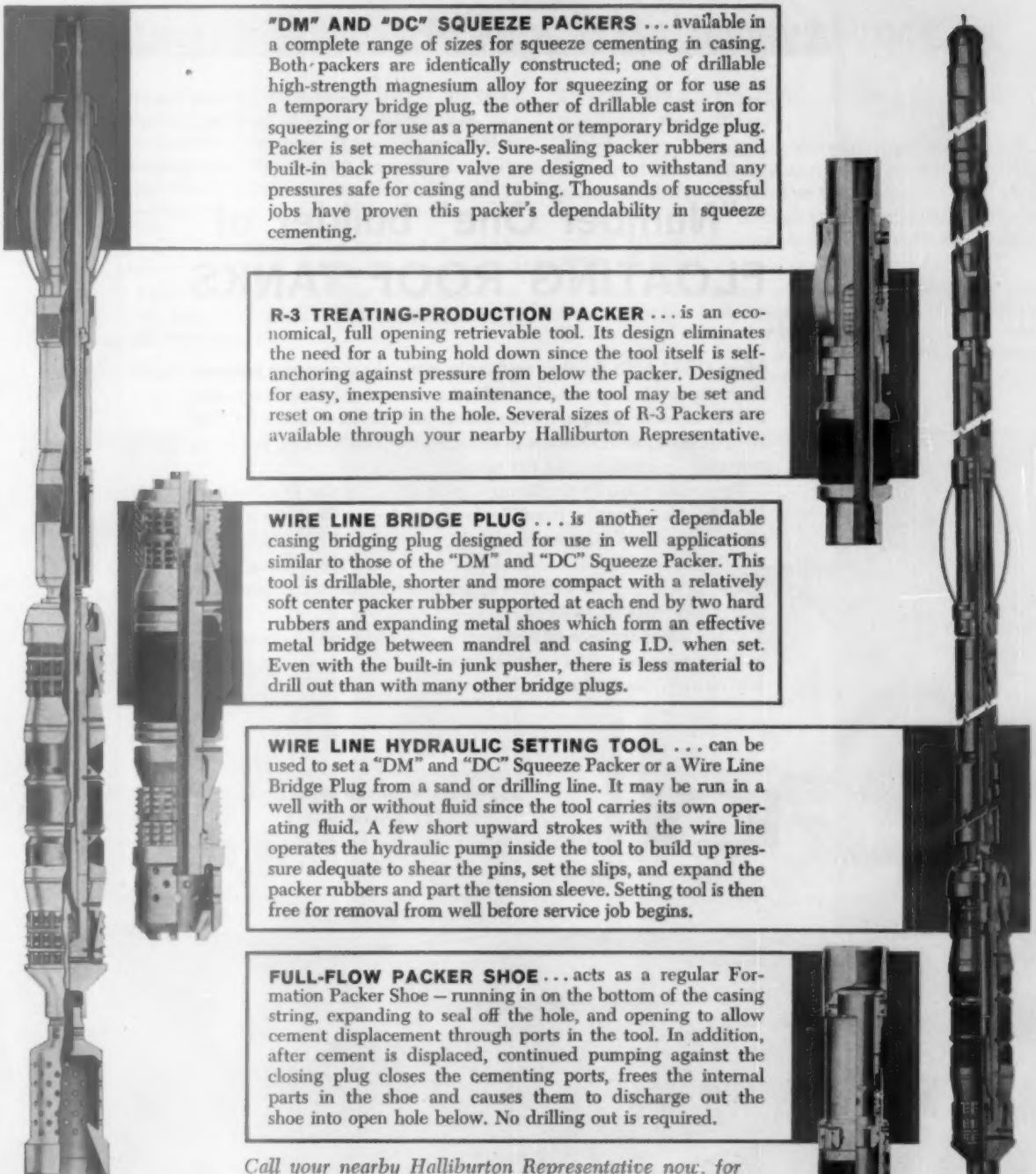

**"DM" AND "DC" SQUEEZE PACKERS** ... available in a complete range of sizes for squeeze cementing in casing. Both packers are identically constructed; one of drillable high-strength magnesium alloy for squeezing or for use as a temporary bridge plug, the other of drillable cast iron for squeezing or for use as a permanent or temporary bridge plug. Packer is set mechanically. Sure-sealing packer rubbers and built-in back pressure valve are designed to withstand any pressures safe for casing and tubing. Thousands of successful jobs have proven this packer's dependability in squeeze cementing.

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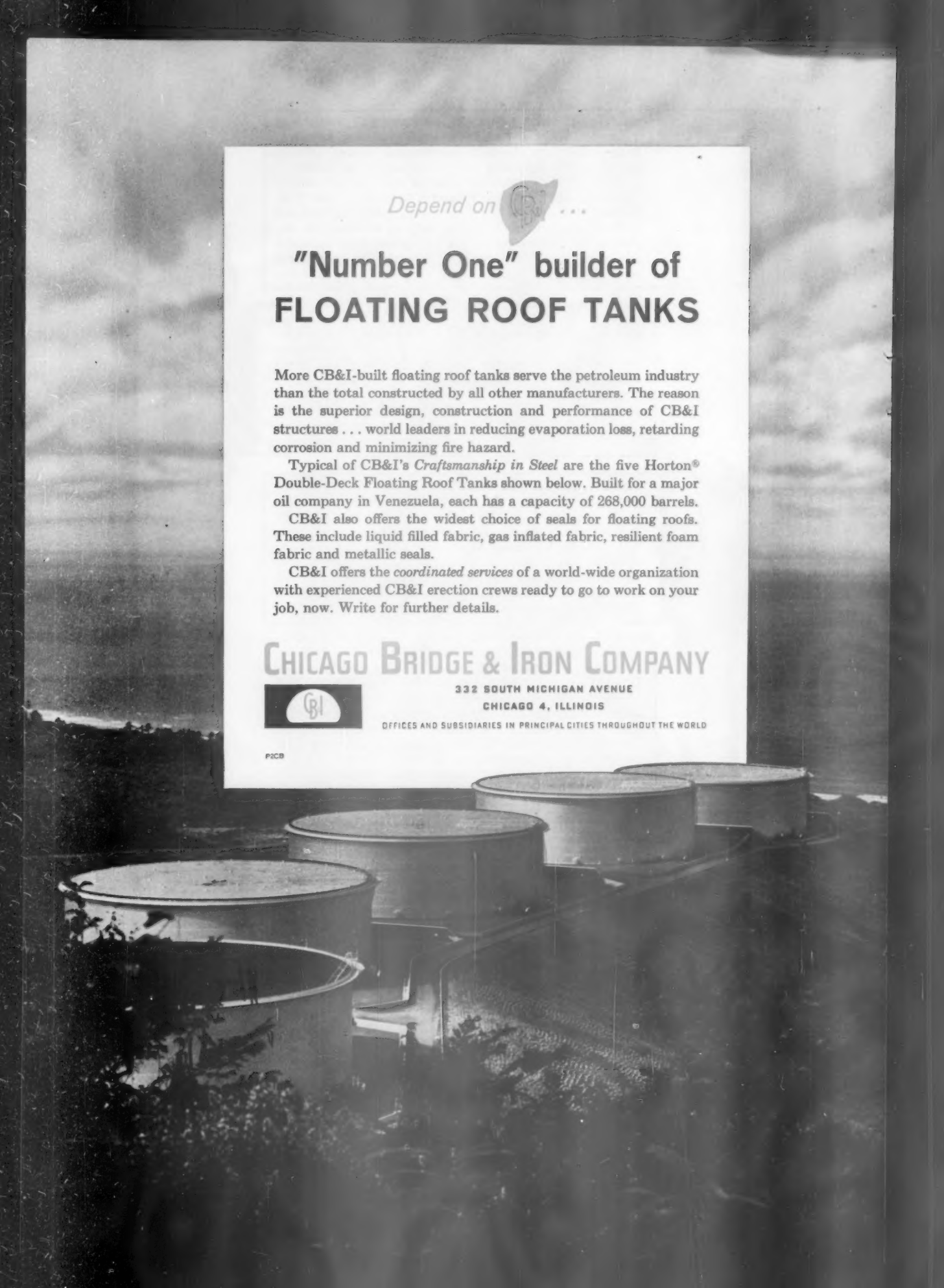

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The result? At last report, the G.T.M.'s hose had drilled 34 wells—213,000 feet of hole. And a good deal of that was tough air-drilling.

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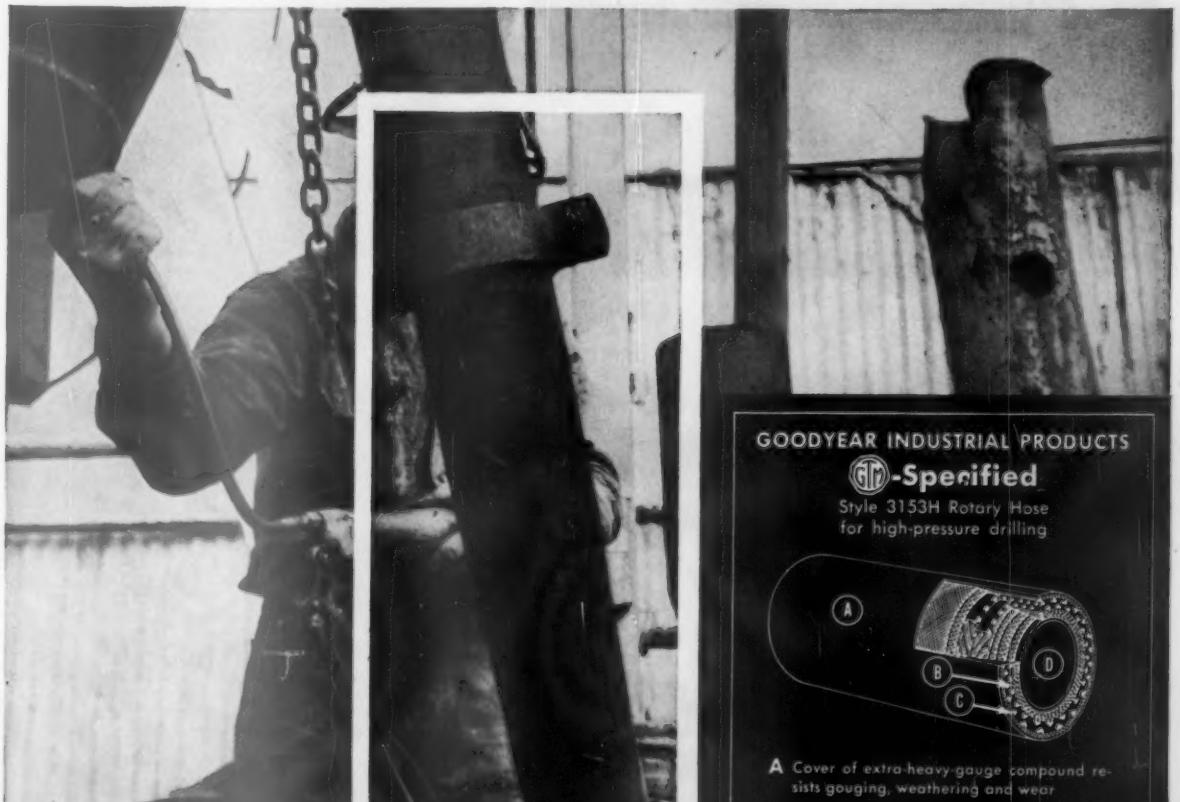
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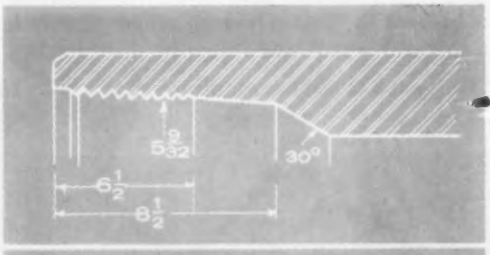
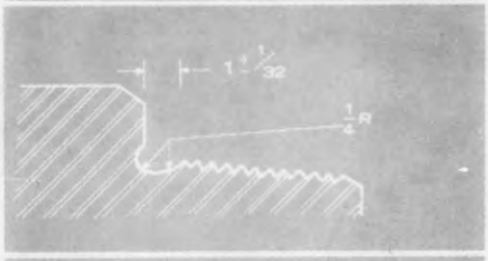
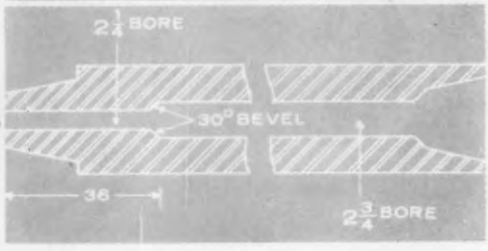
***1. DRILCO BORE-BACK BOX**
ADDED FLEXIBILITY REDUCES FATIGUE CRACKING




***2. API RELIEF GROOVE PIN**
ADDED FLEXIBILITY REDUCES FATIGUE CRACKING




***3. STEP BORE**
INCREASES PIN STRENGTH—DECREASED HYDRAULIC LOSSES




***4. STRESS RELIEF AFTER STRAIGHTENING**
ELIMINATES CROOKED COLLARS IN TOUGHEST SERVICE

***5. EXACT HEAT TREATING**
GREATER IMPACT RESISTANCE—UNIFORM HARDNESS THROUGHOUT BAR

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DRILCO OIL TOOLS inc.

**Drill Collar Stabilizers — Rotary Reamers — Drill Collars**
**Subs — Drill Collar Torque Indicators**

Drawer 3135, Midland, Texas

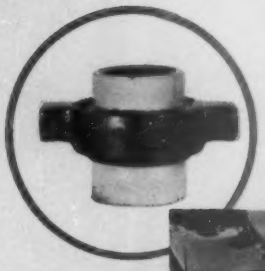
*Here's a man who knows...*

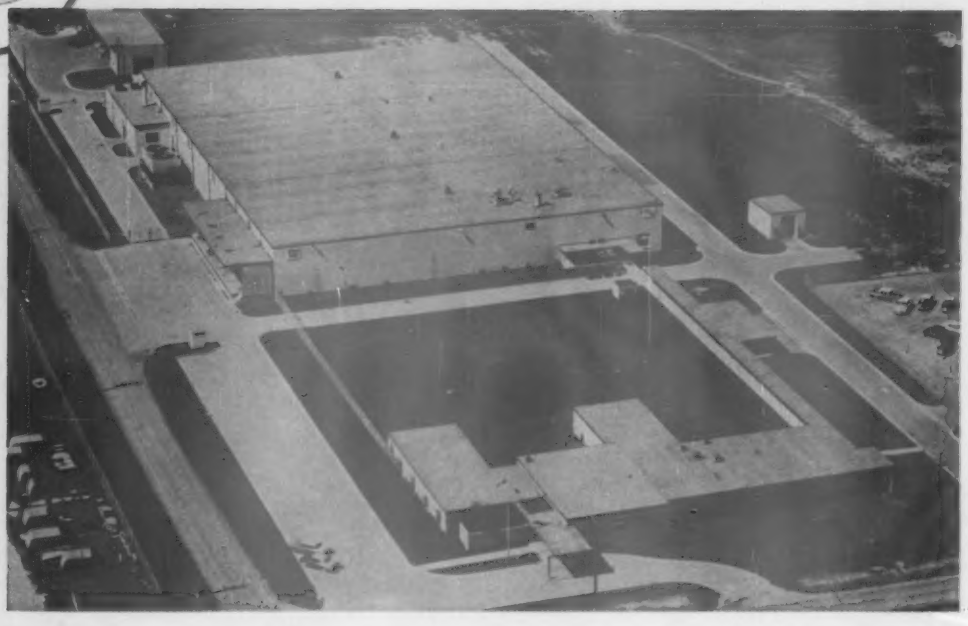
**the importance of QUALITY,**

**the value of PRODUCT SERVICE,**

**the advantages of STANDARDIZATION**

WECO





*and here's the home of Quality Built*

# WECO UNIONS

**The quality, service, time and money saving advantages of WECO Unions have been proved by 25 years of service to the drilling industry. Today, their advantages are more important (and more pronounced) than ever to the Drilling Contractor. He can depend on the ball and cone seat of WECO Unions to seal perfectly on well after well. The strong wing nut, the heavy duty Acme threads and precision machined pipe threads are assurance of easy make-up and break-out on well after well. By standardizing with WECO Unions on all of his rigs he is sure of 100% interchangeability in the same size and pressure rating . . . a positive time saver when rigging up and a real money saver when switching equipment from rig to rig.**

**The most complete line of wing unions in the world, WECO has the size and pressure rating for every rig requirement . . . for every production hook-up. Stocked by Supply Stores everywhere, they are readily available wherever rigs are running.**

WECO®

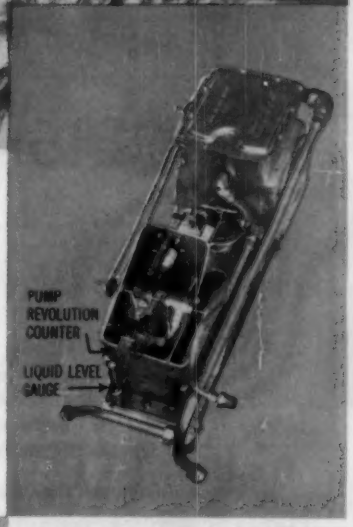
**WELL EQUIPMENT MFG. CORP.**
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

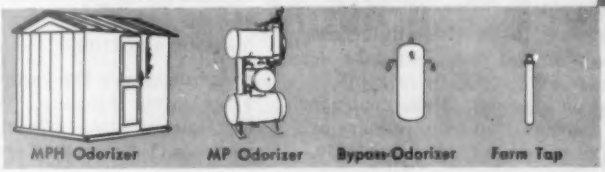
U-6-59

# Over 1200 Peerless Gas Odorizers in service...




**Peerless puts the right smell in gas . . . from the largest odorizer to bypass or farm tap.**

Heart of the largest Peerless meter type MP Odorizers is the internal mechanism shown at the right . . . pump revolution counter and liquid level gauge make sure of constant odorizing rate regardless of variations in flow, temperature and pressure. The skid-mounted odorizer station type MPH, in the illustration above at right is a complete packaged unit . . . quickly installed and ideal for locations where no noxious odors are permitted. For small loads there are the Peerless units shown below . . . including bypass odorizer and farm tap. For *all your gas odorizing needs* get in touch with your nearest Peerless Representative today.




**Peerless Internal Mechanism above provides accurate control of odor into the gas stream. Unit is sealed in central vessel of Peerless Odorizer between odorant storage and safety tanks. Tempered glass windows in "O" Ring closure provide visibility to counter and gauge.**

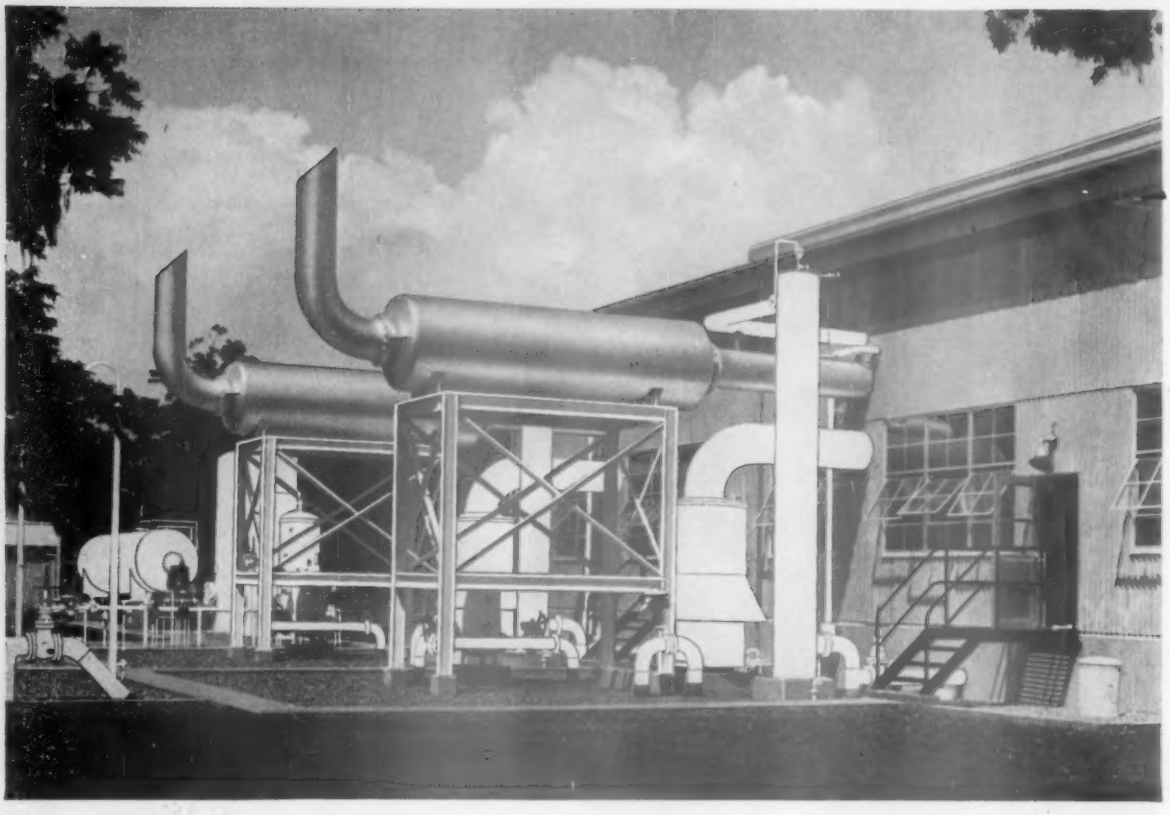
SEPARATORS: Liquid Vapor
DUST SCRUBBERS: Wet and Dry Types
GAS FILTERS
GAS ODORIZERS
SILLERS CLOSURES
OTHER PRODUCTS: Engine Timers, Scraper Traps, Manways

PEERLESS MFG. CO. DALLAS, TEXAS

# PEERLESS MFG. CO.

*Representatives in All Principal Cities*

P. O. Box 13165 • Dallas 20, Texas



# PITTSBURGH FORTALKYD FINISHES

## *Resist corrosive action of industrial fumes and salt air*

● **Wherever exterior painting** of refineries, compressor stations, and tank farms is required, Pittsburgh FORTALKYD Finishes are being specified in steadily increasing volume.

● **FORTALKYDS are special alkyd-type formulations,** fortified with plastic resins to hold color and sheen longer, even in areas where industrial gases and humid salt air are prevalent.

● **Made with lead-free pigments,** these coatings resist staining and discoloration from refinery or oil-patch fumes. You can wash them repeatedly.

● **FORTALKYDS can be used** on steel, wood, concrete, masonry, and asphaltic or coal tar insulating mastics. They dry to a lustrous, non-yellowing sheen, resist fungus and mildew, and are flame-retardant.

● **Choose from a wide range of colors,** including pastels and deep tones suitable for banding, marking and trim.

● **Let us prove the many advantages** of these FORTALKYD Finishes. Write, wire or phone Pittsburgh Plate Glass Company, Industrial Finishes, 1 Gateway Center, Pittsburgh 22, Pa.

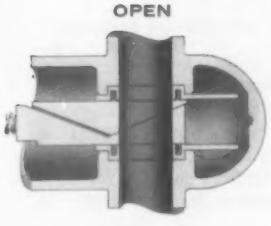
# PITTSBURGH INDUSTRIAL FINISHES

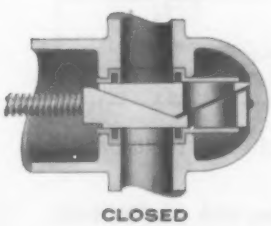
PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

OPEN





CLOSED

# Get the extra margin of control in W-K-M Multiple Completion Valves

Available in no other integral multiples, the famous W-K-M Parallel Expanding Gate lets you control the *seating force* as well as the action of opening and closing.

This extra margin of control lets you close the valve to *absolute shut-off* . . . open it until the gate assembly is sealed positively against the seats for *perfect through-conduit* flow. Result: *no* turbulence to cause erosion or abrasion.

The extra protection of W-K-M Integral Multiples is the most economical production insurance you can buy.

Types: Duals to 10,000 lb.; Duals with Cross to 5000 lb.; Triples to 10,000 lb.; Triples with Cross to 5000 lb.; Quadruples to 5000 lb.

W-K-M

DIVISION OF ACF INDUSTRIES INCORPORATED

P. O. BOX 2117, HOUSTON, TEXAS

6001

# "I don't believe in fluid-loss additives!"

Maybe *you* don't, Oliver, but have you heard about all the service companies that *do*? Their fracture extension calculations—more times than not—predict the need for an effective fluid-loss additive. And that's where remarkable new ADOMITE-MARK II comes in.

In over 25,000 fracturing treatments, ADOMITE fluid-loss additives have produced a consistent record of larger fractures and faster payouts . . . with greatest long-run economy!

So, don't be fooled or tempted by the lower initial cost of less satisfactory techniques.

*For larger fractures per volume of fracturing fluid . . . or same-size fractures with less fluid volume . . . insist on ADOMITE!*

Remember: among operators who use a fluid-loss additive, eighty per cent choose ADOMITE!

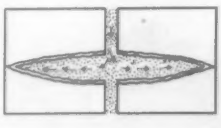
Changed your mind, Oliver?

For more information, contact your service company or the nearest ADOMITE man:

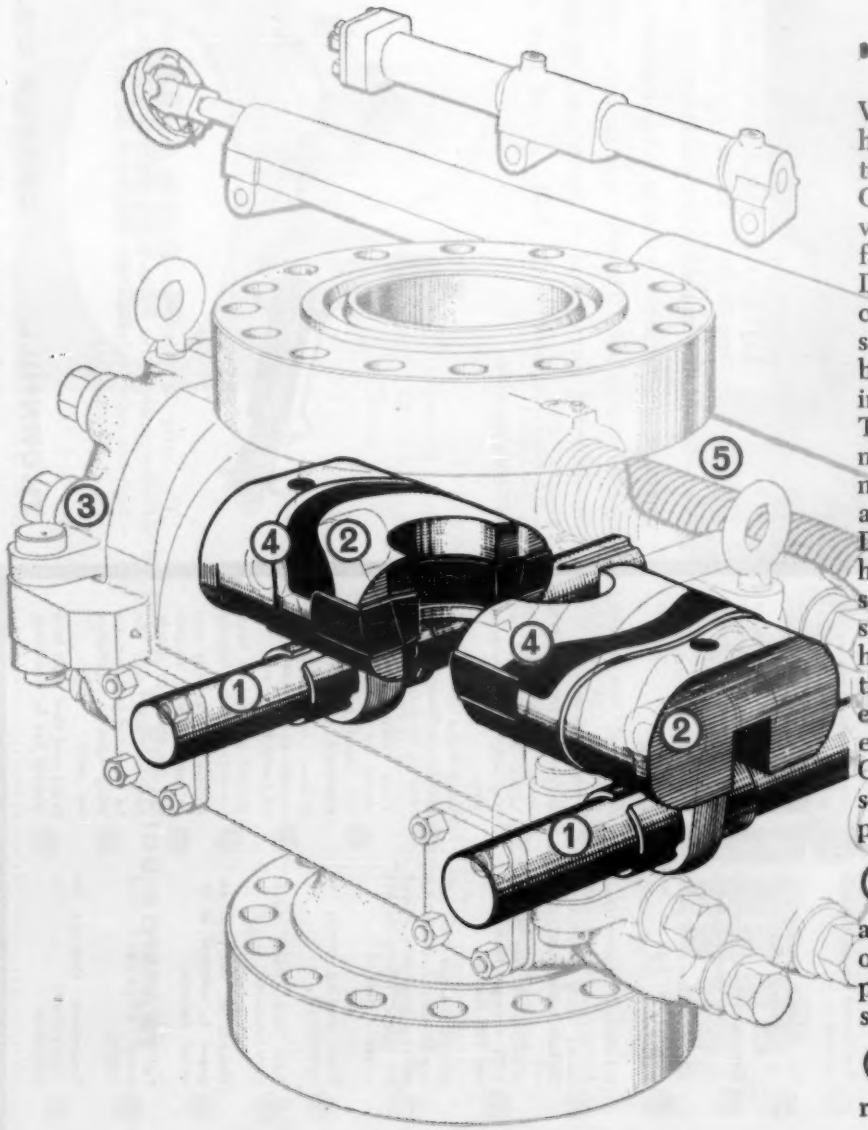
R. T. Means, P.O. Box 431, Midland, Texas, MU 4-7411
T. M. Brown, Pampa, Texas, Phone MO 5-2992
J. M. Foster, Wichita Falls, Texas, Phone 723-8181
J. D. Hawsey, Midland, Texas, MU 4-7411
R. W. Hughes, Oklahoma City, Okla., Phone CE 2-1371
H. L. Thomason, Casper, Wyoming, Phone 3-3721

**ADOMITE®**

... fluid-loss additives



*"25,000 larger fractures can't be wrong!"*




## KEEP PROFITS PRESSURE IN PLACE

When you are drilling, keep down-hole pressure in place if you want to keep profits in place.

Cameron Type "F" Blow Out Preventers are your best bet for a safe, fast, profitable completion.

Demands on equipment have changed – with higher pressures, safety is more important than ever but economy is also an increasing consideration. With Cameron Type "F" Preventers, increased mechanical efficiency results in a more compact design with many advantages.

Design development at Cameron has been intensive and continuous since our introduction of the first successful blow out preventer. We have always had one objective – to bring you the safest, most economical pressure control equipment.

Call your nearest Cameron representative, he can help you keep pressure down and profits up.

(1) Transverse ram shafts are pressure sealed at both ends affording "balanced pressure" operation. Shafts rotate – do not pull abrasives into seals as with sliding rods.

(2) Arms and rollers operate in Tee slots to close and open rams. Design geometry produces fast movement until rams engage pipe (or each other in blind application), at which point movement speed is reduced and sealing pressure is tremendously increased.

(3) Compact hinged bonnets allow easy access for simplified ram changing. When fully retracted the roller and arm assemblies drop free of the rams. Ram bores are relieved toward bonnets to ease ram removal.

(4) Ram packing is self-sealing and self-feeding, with a big reserve of tough oil-resistant Hycar rubber. These packing elements are built to take the rough treatment they are bound to get.

(5) Simplified hydraulic, pneumatic or manual operator is attached to one side only. With balanced pressure design far less force is required to close and open the preventer. Operators can be removed and overhauled or replaced while drilling with no loss of rig time.

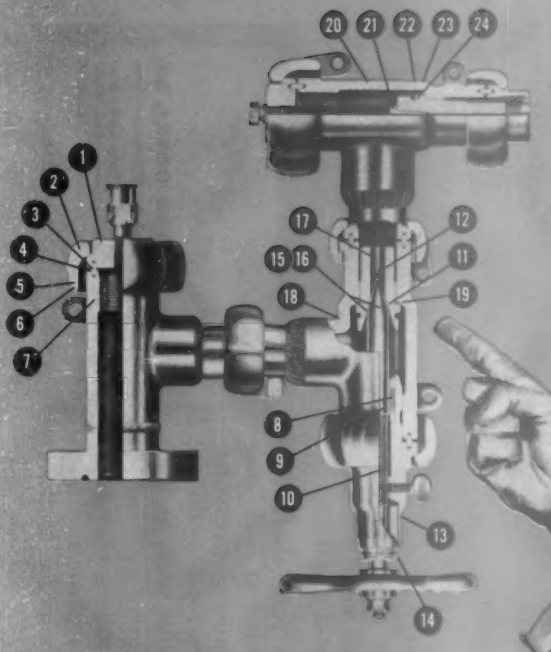
Cameron

**IRON WORKS, Inc.**

P. O. Box 1212, Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., 76 Gresvener St., London W. 1 England.

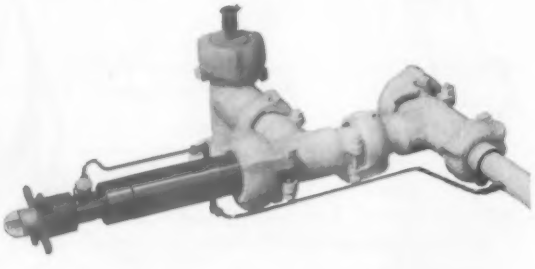
# See how much more you get with a UNIBOLT Christmas tree flow manifold



**These are the "Extras" that make UNIBOLT the best buy of all manifolds**

1. Tee cannot be accidentally opened.
2. No exposed threads . . . no accidental damage.
3. Concealed seat in groove . . . no accidental damage.
4. All metal seat . . . not affected by high or low temperature.
5. Lubricators, bottom hole pressure adapters, and valves easily attached to Unibolt connection.
6. 2"—3000 lb. wp Unibolt 28% stronger than 2" — ser. 900 flange.
7. Unibolt stronger than tubing threads . . . ideal for working trees with welded lift nipple. Tubing threads in tee if desired.
8. Stem packing needs no tightening.
9. Stem turns freely under high pressures.
10. Threads on stem not exposed to external or internal damage.
11. Full 2½" pilot for true stem alignment and rigidity.
12. Streamlined flow — no obstructions . . . no turbulence.
13. Wing Valve requires no grease to effect a seal . . . may also be used as micrometer-gauged flow bean.
14. Variable choke speeds up initial clean-up or running initial flow tests . . . saves rig time.
15. Nitride hardened stem and stem seat . . . resists corrosion.
16. Choice of hard chrome plated or "SA" stainless stems and seats.
17. Unrestricted 1" opening in Wing Valve will pass 10,000 bbls. of fluid per day with 100 lbs. pressure drop.
18. Wing Valve can be completely overhauled without removal from tree.
19. Wing Valve stem seat sealed by power threads and metal gasket assure alignment.
20. Positive Choke Body takes regular or "X" Beans . . . all beans flow-rated.
21. Shaped entrance on beans prevents paraffin clogging.
22. Positive Choke Body may be replaced with inexpensive tee and cage nipple.
23. Positive Choke Body can be converted to Adjustable Wing Valve by substituting two parts.
24. Beans and stem seats have external hex for wrenching.

In addition to these distinctive features, the UNIBOLT Flow Manifold eliminates impingement of flow and negative pressure areas. It may be salvaged completely or as separate units. The three separate units provide flexibility in arrangement of connections. All parts are easily replaced in the field . . . all parts are interchangeable.



The valve in this manfold is the new UNIBOLT Pressurematic Valve which is a combination automatic high-low safety valve and manually-operated wing valve for choke changing.

**THORNHILL CRAVER CO.**

P. O. Box 1184, Houston, Texas

# THREDKOTE 701

*is the tool joint Thread Compound that contains* **60% zinc**

Humble THREDKOTE 701 gives you the lubrication and protection you need and want. The zinc effectively guards against metal-to-metal contact and prevents galling as the string is run. THREDKOTE 701 maintains its quality and assures protection under the most rugged running conditions.

Delivery is quick. Order THREDKOTE 701 from your nearest Humble bulk plant in Texas, New Mexico and Arizona. Other areas contact Humble Oil & Refining Company, Houston, Texas.

HUMBLE

**HUMBLE OIL & REFINING COMPANY**

# TELETAX* TELEMETERING

## by Foxboro...

### engineered for the most advanced transmission techniques

Telemetering matched in performance with famous Foxboro instruments — that's the Foxboro Teletax Telemetering System.

Through use of impulse-duration signals, Teletax electrically transmits measurements of a remotely-located variable to the central control station. Here, the Teletax receiver records the duration of impulse, which is directly proportional to the measured variable.

The Foxboro Teletax System is noted for its simplicity, its versatility, and its high sustained accuracy. For a transmission medium, it can use either AC or DC, an audio frequency carried on a transmission line, or radio or microwave impulses. Sustained accuracy is 0.5% of full scale.

*Reg. U. S. Pat. Off.

**TELETAX RECEIVERS**

Teletax receivers include: Single or Dual Receivers; Multi-Record Receivers for recording up to 6 separate measurements on one chart; and Teletax Receiver-Controllers for automatic operation. And the Teletax signal can be simply converted to digital information.

**TRANSMISSION LINK**

With Foxboro's Teletax Telemetering System, you can use the most advanced transmitting techniques: two wire lines, power lines, radio or microwave. As many as 25 different signals can be handled in each direction, simultaneously.

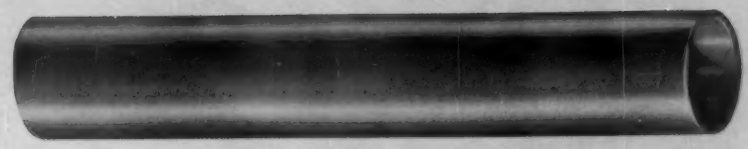
**TELETAX TRANSMITTER**

The Teletax Transmitter houses either one or two standard Foxboro measuring elements — plus the Teletax transmitting mechanism. It will transmit to a control center hundreds of miles away just as easily as to one nearby. It also indicates or records locally if desired.

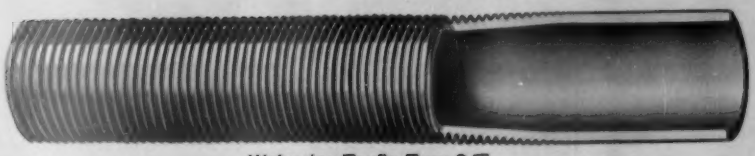
The Teletax Transmitter needs no periodic maintenance whatever, while the receiver requires only occasional oiling. And the receiver has a minimum of mechanical components to wear — no clutch to slip or jam.

Foxboro Teletax Systems are now in wide use on natural gas systems, water works, oil fields, power plants, steel mills, etc. Write for Bulletin 17-11C — it gives all the details. **The Foxboro Company, 609 Neponset Avenue, Foxboro, Mass.**

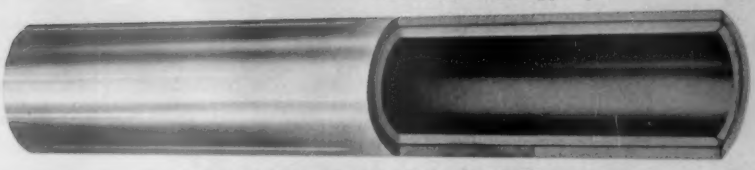
FOXBORO
REG. U.S. PAT. OFF.
**TELETAX TELEMETERING**



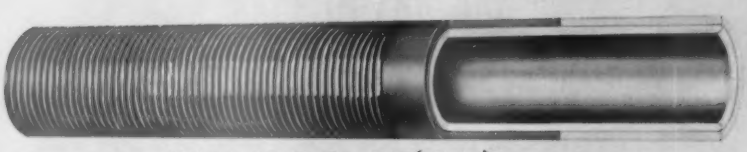
Wolverine Prime Surface Tube



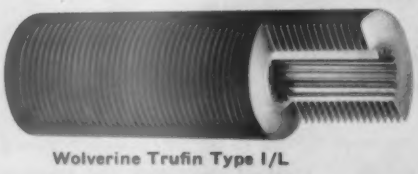
Wolverine Trufin Type S/T



Wolverine Prime Surface Tube (Duplex)

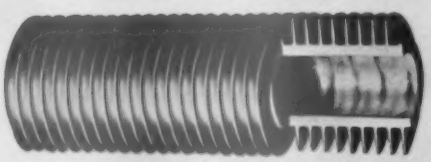


Wolverine Trufin Type S/T (Duplex)

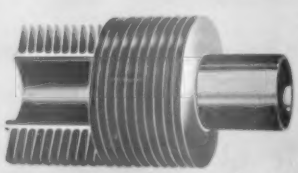


Wolverine Trufin Type I/L

Wolverine Trufin Type H/R

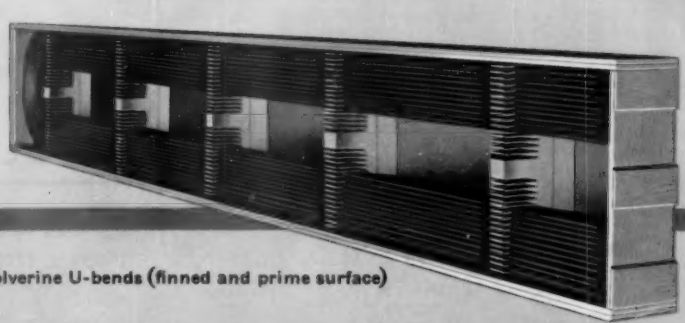


Wolverine Trufin Type H/A



Wolverine Trufin Type L/C (Bimetal)

# Here's why you should buy condenser tube from WOLVERINE TUBE



Wolverine U-bends (finned and prime surface)

# BECAUSE

when you want inside information about a product, one of the finest places to get it . . . is right from the people who make the product. They know all about it because their livelihood . . . their very future . . . is tied to the way their product meets *your* requirements and wins *your* acceptance. Recently, we asked Wolverine employees why they thought that equipment builders and processing companies should buy Wolverine condenser tube. We believe their reasons offer you some very significant buying considerations:

"BECAUSE we perform an expansion test on a sample taken from the end of *every* length of condenser tube."

"BECAUSE we use the most modern control techniques available to assure top quality."

"BECAUSE we manufacture a complete line of nonferrous condenser tube making it possible for our customers to buy finned or prime surface condenser tube in almost any popular alloy."

"BECAUSE we were the first to develop integrally finned tube—since we have more than 25 years of experience and know-how our product superiority and tubular competence is especially high."

"BECAUSE we can supply seamless condenser tube in special metals such as zirconium, titanium, etc."

"BECAUSE we have a continuous program for the development of our products through our separate Research and Development facilities."

"BECAUSE we are quality conscious."

"BECAUSE we understand good packaging practices and will unitize or palletize tubing requirements to meet the needs of our customers."

"BECAUSE we want the good will of our customers as well as their business."

PRIME SURFACE TUBE

WOLVERINE TRUFIN TYPE S/T

may we have your next condenser tube order?

**WOLVERINE TUBE**
DIVISION OF
**Calumet & Hecla, Inc.**
DEPT. E, 17238 SOUTHFIELD RD., ALLEN PARK, MICH.
Manufacturers of Quality-Controlled Tubing

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA.
SALES OFFICES IN PRINCIPAL CITIES

NOW MADE IN ENGLAND
by Rob't. Cort & Son, Ltd.
MAINTENANT FABRIQUÉ EN FRANCE
par Grove France S.A.
ORA FABBRICATA IN ITALIA
da Nuovo Pignone

GROVE G-4 SEAL "O" RING® GATE VALVES

are now being manufactured in England, Italy and France to assure availability of these proven pipeline valves throughout the world. Grove G-4 Gate Valves feature proven double-action sealing: a primary metal-to-metal seal backed up by protected o-rings to assure a positive bubble-tight closure. Another major advantage—Grove G-4 Valves never need lubrication. Dependability has made Grove G-4 the most popular "Big" Gate Valve in use today. Please address inquiries for technical data to Grove France S. A.

GROVE PIPELINE VALVES
GROVE VALVE AND REGULATOR COMPANY
Oakland 8, California — a subsidiary of Walworth
Subsidiary: Grove France S. A., 24 Avenue de la Grand-Armée, Paris 17e
Western Continental European Sales Representative,
except Italy: Pétrochimie, 77 Rue la Boétie, Paris 8e
Licensees: Nuovo Pignone, Casella Postale 487, Firenze, Italy
Robert Cort & Son, Ltd., Reading, England

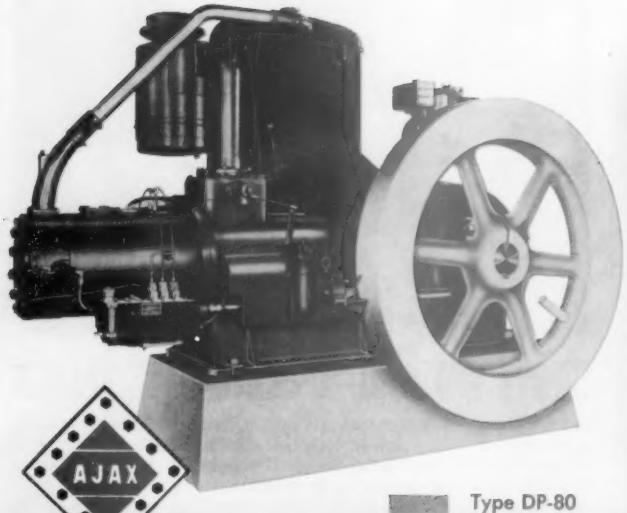
WHEN YOU INVEST IN AN AJAX PRODUCT YOU CAN BE CERTAIN IT HAS BEEN PROVED IN ENGINEERING AND PERFORMANCE. YOU ARE NOT A PART OF THE MANUFACTURER'S "EXPERIMENTAL" PROGRAM.

Shown below (left) one of the new DP-80 Ajax long service engines and on the right the TPBL TP-5000 Ajax pump, 5" stroke, Type TPBL 5375 rated at 112 HP . . .

Send for the new brochure on the new Ajax Engines and Single Cylinder Engine-Compressors . . .

Now as always — a full dollar's proven value in every Ajax product — all ways.

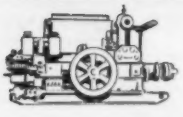
# *Are you a "GUINEA PIG" Customer?*

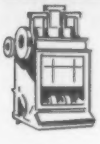



Type DP-80

TPBL-5375 Pump

**ALWAYS A FULL DOLLAR'S VALUE IN AN AJAX PRODUCT**





**AJAX . . . also builders of COMPRESSORS —— PUMPS**

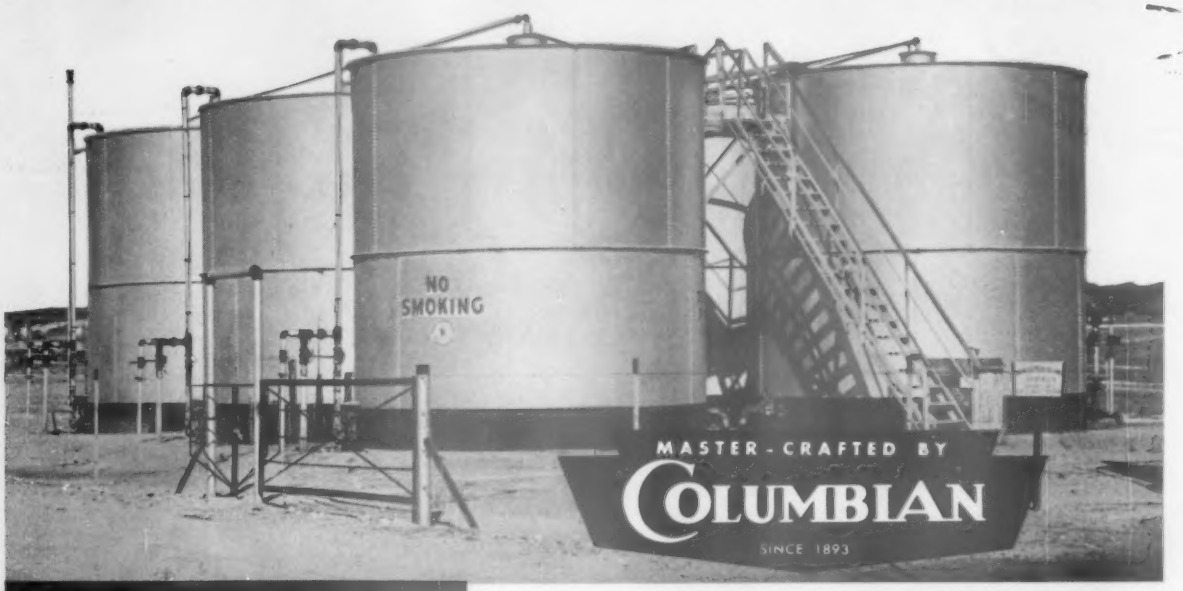
**AJAX IRON WORKS** CORRY, PENNSYLVANIA

*Oil Field Distributors*

- The National Supply Co. — Pittsburgh, Pennsylvania
- Bethlehem Steel Co. — Supply Division, Tulsa, Oklahoma
- Mid-Continent Supply Co. — Fort Worth, Texas

On every
Milwhite
desk . . .
We must
continually work
for Decreased
Drilling Costs
for our
Customers.
MILWHITE
MILWHITE MUD SALES COMPANY
HOUSTON, TEXAS
A DIVISION OF MISSISSIPPI RIVER FUEL CORPORATION

# "FOR KEEPS"...BOLTED STEEL TANKS



**COLUMBIAN RIGID FRAME Steel Buildings — More Strength and Usable Space**

Maximum unobstructed floor space and overhead clearance surrounded by tremendous strength are the essence of Columbian RIGID FRAME Steel Buildings. They go up in *days*, not weeks or months, need little maintenance, are fire-safe, and are quickly moved or expanded at minimum expense. Ideal for field offices, equipment sheds, warehouses, pump houses. Available in widths of 32′, 40′, 50′, 60′ and 70′ and in lengths in multiples of 20′. Your Columbian distributor can help you.

**FREE FACTS! Write us today for Steel Tanks booklet and Steel Buildings folder.**

Columbian *Master-Crafted* Bolted Steel Tanks *keep* their greater tightness, strength, safety and durability more economically over a longer, trouble-free life. And they're readily available and quickly erected.*

Columbian Bolted Steel Tanks — with almost seven decades of experience behind them — have become accepted as the standard of excellence in petroleum storage.

It comes to this: When you specify Columbian *Master-Crafted* Bolted Steel Tanks, you *know beyond question* you're getting the best storage available anywhere.

***FASTER INSTALLATION — Call your nearest COLUMBIAN DISTRIBUTOR**

**COLORADO**
O'Neill Tank Co.
Sterling

**ILLINOIS**
Duane E. Wollner, Inc.
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O'Neill Tank Co.
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**COLUMBIAN STEEL TANK COMPANY** P.O. Box 4048-J Kansas City, Mo.

Reg. U.S. Pat. Off. TANKS FOR THE WORLD

*STEEL, Master-Crafted by Columbian . . . First for Lasting Strength*

We do contract steel fabrication

Hydro Hook
W W
Pick the finest
ALL FROM ONE MANUFACTURER
BAASH-ROSS
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TYPE
CONTACT YOUR
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OUR 41ST YEAR OF PROGRESS
Baash-Ross and Web Wilson Tools are sold only thru supply stores
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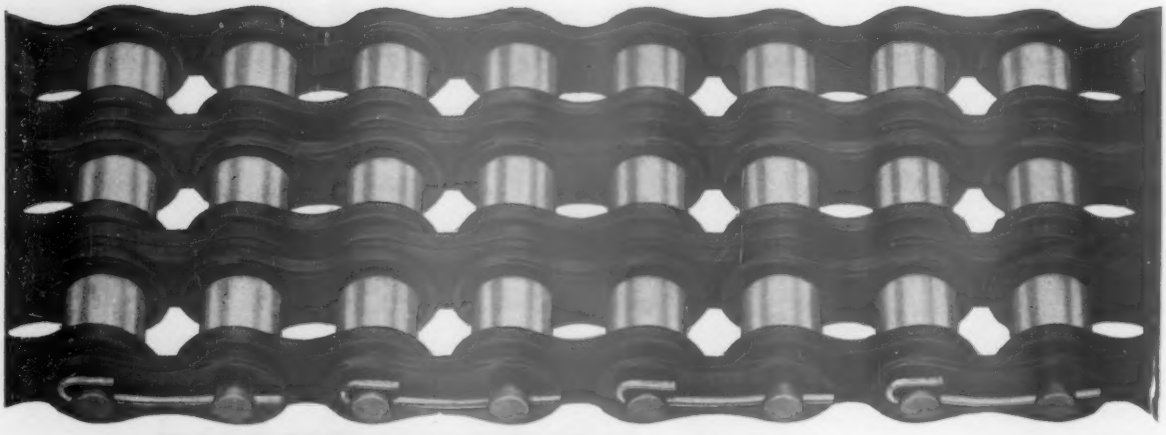
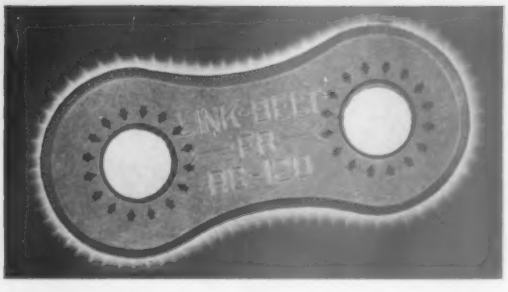
BAASH-ROSS
DIVISION OF JOY MANUFACTURING CO.
General Offices: Houston, Texas





Arrows indicate critical areas treated with compressive stresses to improve fatigue resistance.

# Fortified against fatigue

**BREWSTER N-85 DRAWWORKS** is equipped with Link-Belt multiple-strand precision steel roller chain with "FR."

## LINK-BELT FR® oil field roller chain stands up to tremendous stresses of modern drilling service

The smashing impacts and tortuous stresses met in day-to-day drilling are taken in stride by Link-Belt FR (Fatigue Resistant) roller chain. Through its patented FR process, Link-Belt gives its roller chain *greater dynamic strength*. FR greatly raises the chain's endurance limit by compressing metal around pitch holes—the critical sidebar areas most vulnerable to fatigue failure.

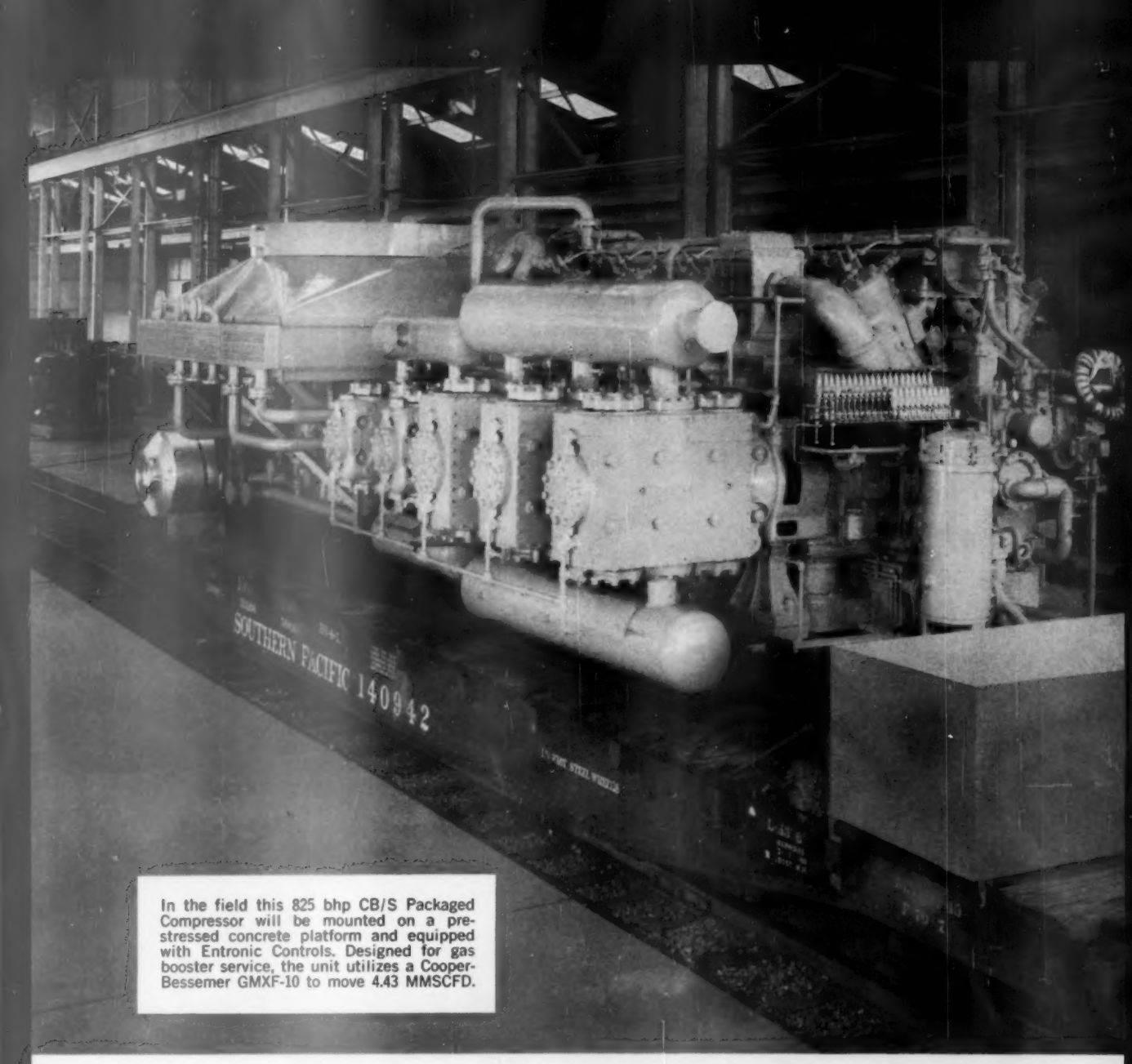
The FR process results from the same design and metallurgical research that has produced many more "extras," all *standard* in Link-Belt oil field roller chains. They include shot-peened rollers, close heat-treat control, Shepherd's Crook Cotters and others. For details, see Catalog 2880. 19.38

**LINK-BELT**

ROLLER CHAINS AND SPROCKETS

**CATALOG 2980** has full information on all Link-Belt oil field equipment. You can obtain a copy from any leading supply store in the field. Also in Composite Catalog of Oil Field Equipment.

**LINK-BELT COMPANY:** Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 6, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.




In the field this 825 bhp CB/S Packaged Compressor will be mounted on a pre-stressed concrete platform and equipped with Entronic Controls. Designed for gas booster service, the unit utilizes a Cooper-Bessemer GMXF-10 to move 4.43 MMSCFD.

Building packaged compressors is our business . . . our only business. This single objective is the reason CB/S Packaged Compressors are more advanced in design . . . more efficient in the field.

CB/S
PACKAGED
COMPRESSORS

CB/S

C-B SOUTHERN, INC., P. O. BOX 19267, HOUSTON 24, TEXAS

*A subsidiary of The Cooper-Bessemer Corporation.*

## For trouble-free service on high pressure lines

# *NEW* FISHER 404

## high pressure relief valve

- **POSITIVE SHUT-OFF**
  Numerous field tests show that the 404 gives bubble tight shut-off under all pressure drop conditions.
- **ACCURATE AND DEPENDABLE**
  Repetitive operation, frequent or infrequent, does not interfere with its ability to relieve consistently at its predetermined setting.
- **SIMPLE AND COMPACT**
  Only one moving component in main valve. Only adjustment is pilot spring setting. All internal parts can be removed or inspected in minutes without special tools and without removing the valve body from the line.
- **LARGE CAPACITY**
  Provided by full port body and pilot operation.
- **SUITABLE FOR GAS OR LIQUID RELIEF SERVICE**

### SPECIFICATIONS

Body Sizes—2″ Screwed; 2″, 3″, 4″, and 6″ Flanged.

Body Material—Cast Steel.

Valve Disc Material—Composition.

Body Trim—316 Stainless Steel.

Relief Pressure Ranges—30 to 600 psi.

*FOR COMPLETE DETAILS WRITE FOR BULLETIN P-404*

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

**FISHER GOVERNOR COMPANY**

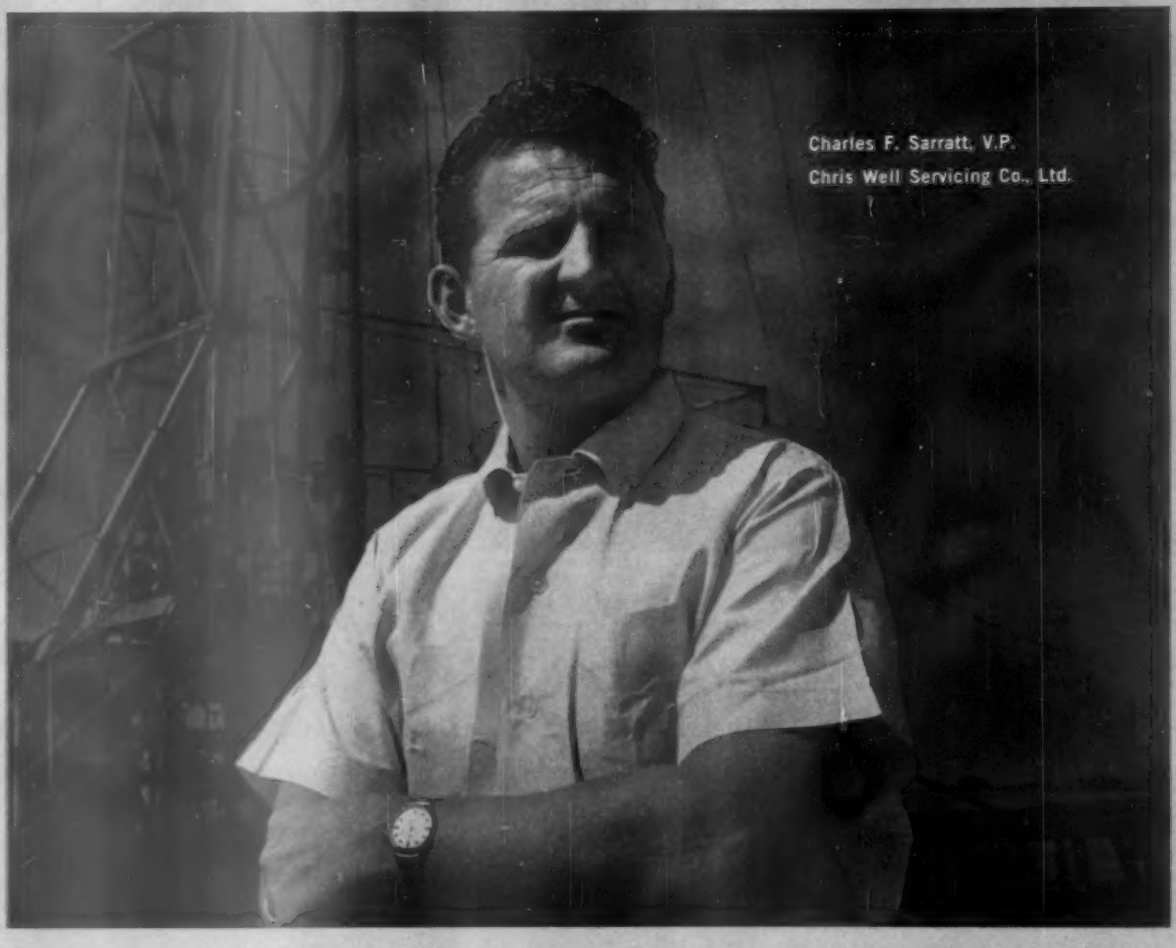
*Marshalltown, Iowa / Woodstock, Ontario / Rochester, England*

BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIP. CO., CORAOPOLIS, PA.

FISHER® Controls

SINCE 1880

# "WHY BUY A NEW RIG? BECAUSE THE RIGHT EQUIPMENT IS VITAL TO SUCCESS IN OUR BUSINESS!"




"Equipment is vital to us—our continued growth depends on our ability to anticipate the future needs of our customers. We needed a self-propelled rig that would do slim hole drilling to a depth of 8,000 feet, and deep workover and deepening jobs down to 15,000 feet. The Cardwell KM250 filled the bill," says Mr. Sarratt. "We can bid on jobs the smaller rigs can't handle, and we can underbid heavier rigs by $50 to $100 a day. Moving and rig-up costs are low, and so is maintenance. We've had only one major repair in a year. The total time lost was only 12 hours, and Cardwell stood behind the rig 100%."

Chris Well deepened the Anderson-Prichard Oil Corporation's No. 1 Gray "A" from 10,832 feet to 12,032 feet—the first well to be deepened by a workover rig through the Bromide into the Oil Creek section. Savings to the operator were substantial—about $1,500 in moving and rigging-up costs, plus more than $50 per day on day rates. The KM250 actually outperformed a heavier rig—drilling the hole through a special technique in 18 days less than a conventional rig on an offset well, and making the 12,000-foot round trip in less time than the heavier rig, which was handling triples.

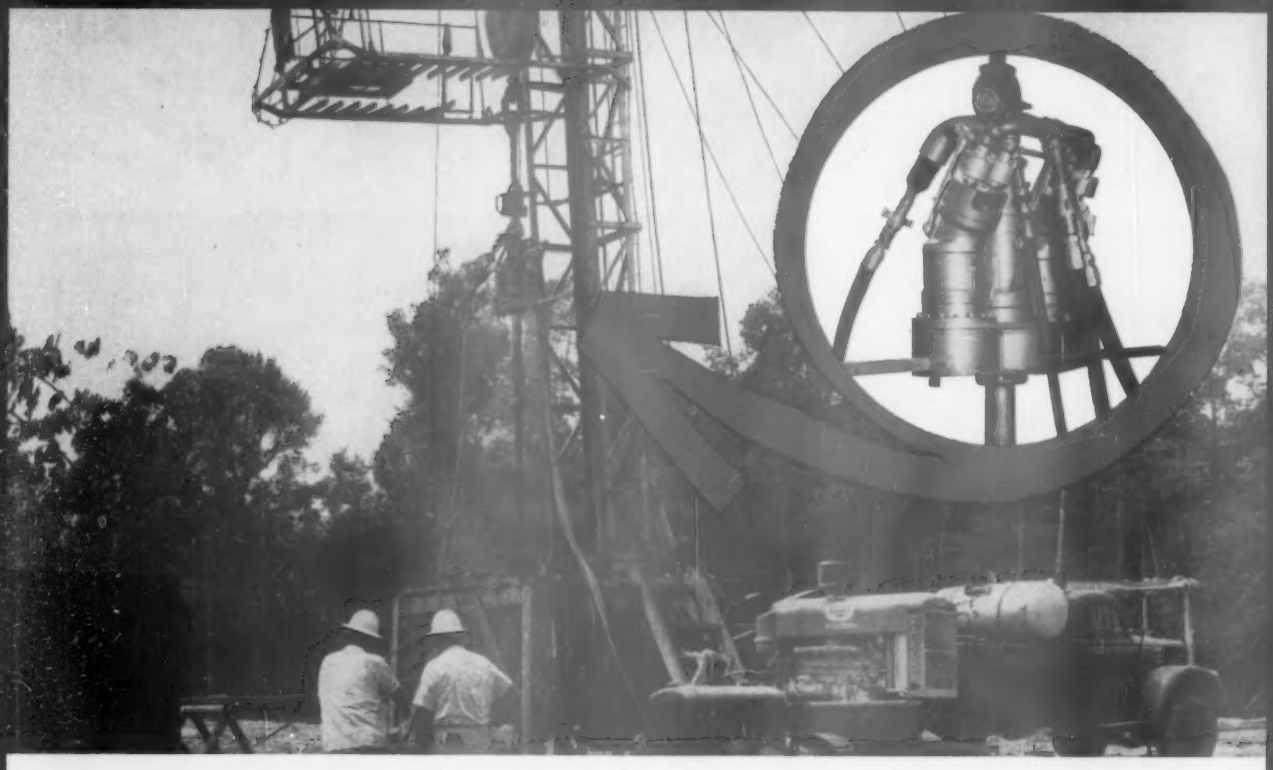
In view of records like these, it's easy to see why progressive contractors favor new Cardwells. Contact us to find out what a new Cardwell rig can do for your profits.

*for tomorrow's equipment—see Cardwell today!*

**cardwell** MANUFACTURING COMPANY, INC.

Box 2001, Wichita, Kansas • Cable: ALLSTEEL • Phone: AMherst 7-3311

*. . . from Wilson Supply . . .*



# *Wilson PS-70 Power Swivel has power to "burn" . . .*

**A new and better power swivel that delivers 4000 ft. lbs. (torque) at speeds of 0 to 100 RPM**

The new Wilson Power Swivel was field-engineered to give operators top performance for . . . workover operations, deepening holes with small diameter pipe, shallow drilling, drilling out obstructions in casing, drill pipe and tubing. It has passed all field tests with flying colors.

Operators have found the Wilson PS-70 Power Swivel is easy to hook up, fast to install in working position and makes connections easily. The Swivel is hydraulic for instant torque, sensitive drilling control. It delivers 4000 ft. lbs. at speeds of 0 to 100 rpm. The unit is capable of handling 70,000 lbs. at 100 rpm and has a static load capacity of 140,000 lbs.

This packaged and unitized Wilson Hydraulic Power Swivel can be purchased or is available on rental basis. For complete information, write for new bulletin or call your nearest Wilson Supply representative.

**The power package of the Wilson PS-70 Hydraulic Power Swivel is a piston-type pump, delivers 43 gal. of fluid at 2500 psi. Prime mover is rated at 67 hp.**

**(Inset):**
Wilson PS-70 Hydraulic Power Swivel has two piston-type hydraulic motors for instant torque . . . sensitive power control

**MAIN OFFICE and WAREHOUSE • 1301 CONTI STREET • HOUSTON, TEXAS**
**INTERNATIONAL DIVISION • 9 ROCKEFELLER PLAZA • NEW YORK 20, NEW YORK**

**WILSON SUPPLY CO**
HOUSTON TEXAS

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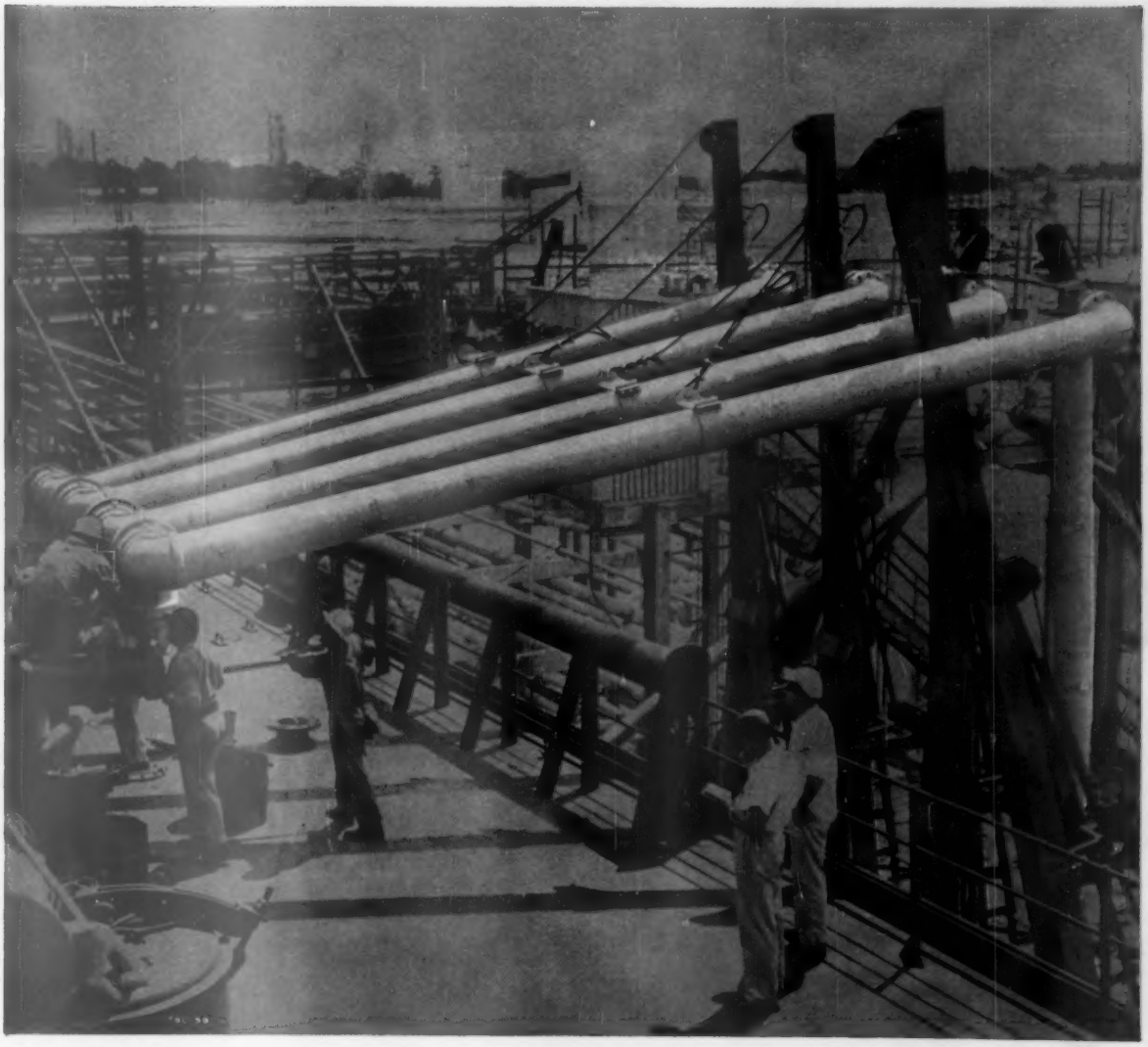
6026

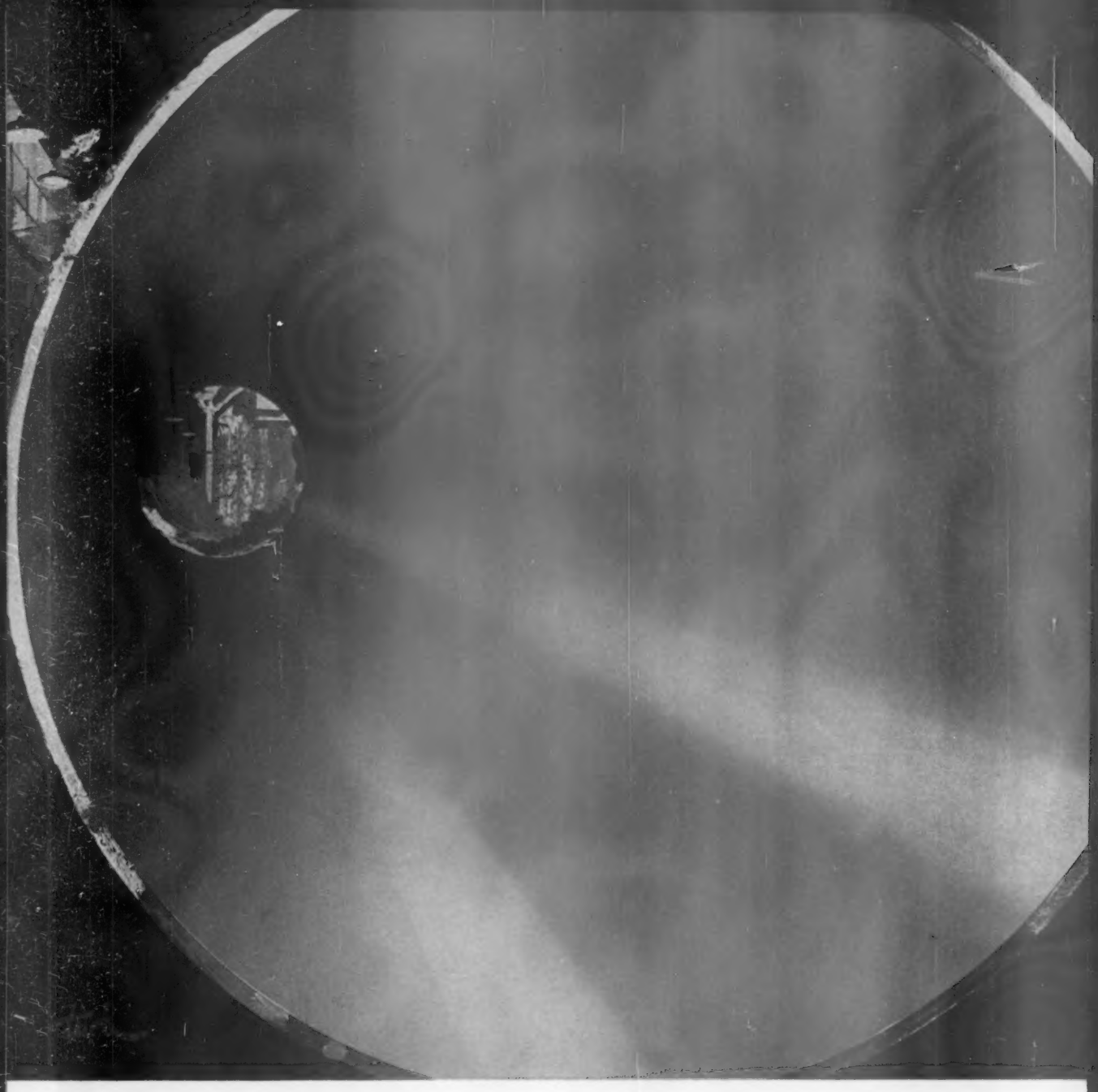
# PROOF OF PERFORMANCE at a major gulf coast refinery.

Nothing says customer satisfaction as strongly as a re-order. Since Chiksan sold its first Hydraulic Marine Loading System in 1955, many original customers have re-ordered. They have learned through actual operation that this is the safest, most efficient, most practical method of modern tanker loading. The Chiksan system shown went into service in September, 1959; additional units have since been ordered. For a quotation on a system for your terminal, write Chiksan, Brea, California.

CHIKSAN

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION





## Now USS National Electric Weld line pipe can be internally coated right at the plant

National Tube has erected new buildings and equipment at the Orange, Texas, and McKeesport, Pennsylvania, plants. Your contractor can use these facilities to apply internal epoxy coating for increased flow efficiency and easier cleaning of line pipe.

The coating facilities are all *under roof* to elimi-

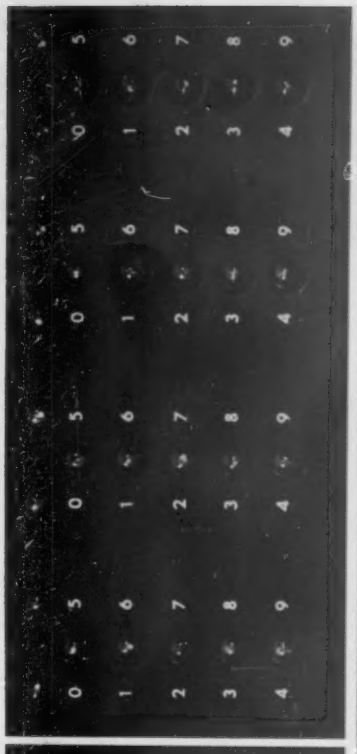
This mark tells you a product is made of modern, dependable Steel

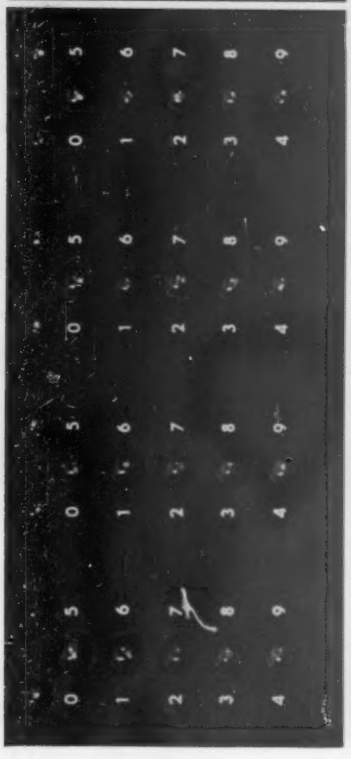
nate weather hazards. No corrosion, water, or dust to complicate coating operations. You get a uniform, high quality internal coating job. We invite you and your coating contractor to visit our plants and see how these facilities can help you. Or write to National Tube, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

*USS and National are registered trademarks*

**National Tube**
**Division of**
**United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

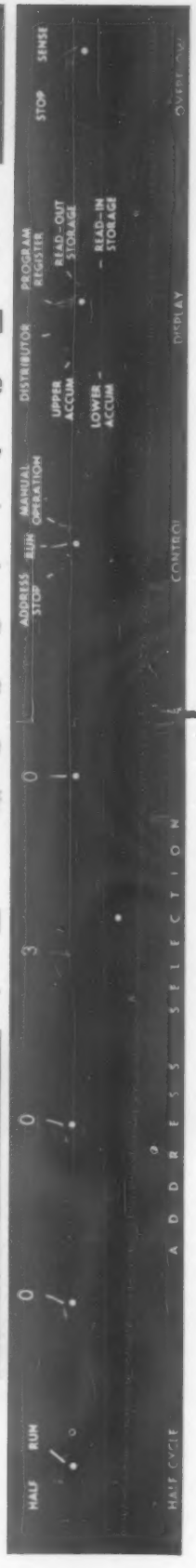




# PROGRESSIVE

From a complete industrial hygiene laboratory to one of the first rehabilitation departments, TEIA has been a leader in providing the most up-to-date workmen's compensation insurance service. This progressive attitude has enabled TEIA to keep pace with the ever changing needs of Texas business and industry.

If you're thinking ahead, you'll want to call the nearest TEIA man.




TEIA

**TEXAS EMPLOYERS' INSURANCE ASSOCIATION**

*First Choice of Texas Industry for over 45 years*

HOME OFFICE: DALLAS | 25 SERVICE OFFICES IN TEXAS | AUSTIN F. ALLEN, CHAIRMAN OF THE BOARD | BEN H. MITCHELL, PRESIDENT

Teeth in ratchet head and socket openings are induction heated for hot forming without tears or ruptures. Over-heating of steel is avoided and decarburization is prevented. Unusual accuracy is attained and the grain structure of the metal remains unbroken.

Completely machined ratchet and socket blanks are heated and quenched in a series of salt baths to develop the proper relationship of toughness and hardness without decarburization or dimensional distortion.

# A Push Button World at WILLIAMS

***produces***

## Detachable Socket Wrenches

***that have RESERVE STRENGTH for THE TOUGHEST JOBS***

**B-52 and S-52 RATCHET FEATURES**

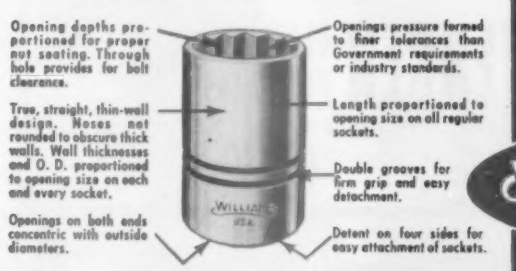
41 tooth give 82 tooth action requiring less than 4½° swing of handle for complete nut rotation.
S-52 "SUPERRATCHET" PATENTED
The harder the pull on the handle, the more teeth that come in contact.
Entire ratchet 50% stronger than U.S. Government requirements.
Soft knurling provides safe, non-irritating grip.
Length directly proportioned to weight distribution for ideal balance, comfort and leverage.

RETAINING RING
NEW... Four-Winged, Non-Slip Shifter Design
Rugged construction. No one part bears bulk of stress.
NEW... Single Unit Construction
Easily removed for cleaning, servicing and replacing
Stresses evenly distributed throughout entire mechanism.

The unique combination of the latest automated equipment and design "know-how" produces a complete line of rugged, detachable socket wrenches which "bear up" under *every* stress condition encountered. Improved grain structure and precisely controlled heat-treating build up an unusual resistance to metal fatigue. These reserves of strength are hidden but guaranteed qualities built into all Williams' wrenches.

***MR. WRENCH SAYS: "Get the Facts ... get TOOLFACTS ... new 24 page booklet on how to select, use and care for Quality Wrenches."***

**DETACHABLE SOCKET FEATURES**


Opening depths proportioned for proper nut seating. Through hole provides for bolt clearance.
True, straight, thin-wall design. Noses not rounded to obscure thick walls. Wall thicknesses and O. D. proportioned to opening size on each end every socket.
Openings on both ends concentric with outside diameters.
Openings pressure formed to finer tolerances than Government requirements or industry standards.
Length proportioned to opening size on all regular sockets.
Double grooves for firm grip and easy detachment.
Detent on four sides for easy attachment of sockets.

**J. H. WILLIAMS & CO.**
Division of United-Greenfield Corporation
**415 VULCAN STREET, BUFFALO 7, N.Y.**

Mr. Wrench: Please send me your new
☐ TOOLFACTS Booklet ☐ ILLUSTRATED CATALOG No. 304

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FIRM_____
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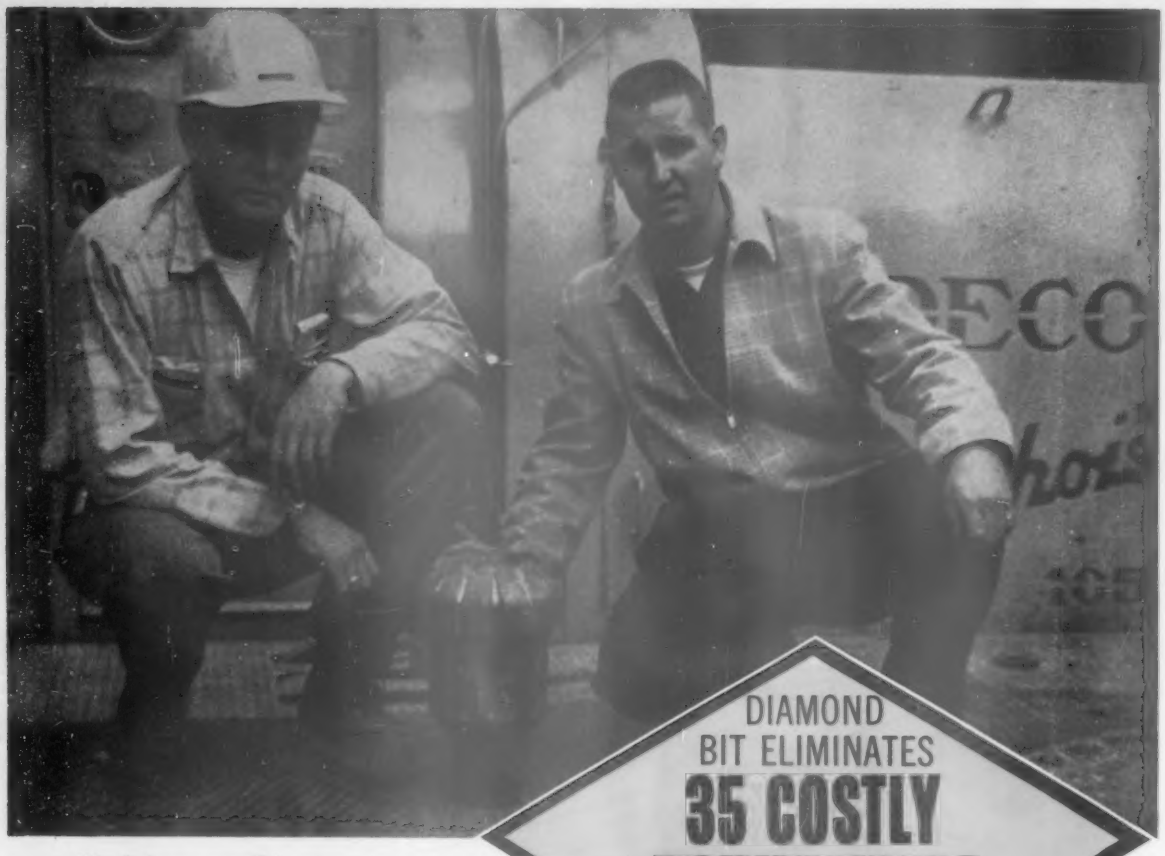
CITY_____ ZONE_____ STATE_____



DIAMOND
BIT ELIMINATES
**35 COSTLY ROUND TRIPS**

## Christensen Diamond Drilling Bit sets endurance record of 28 rotating days on bottom

The new record was set by a major oil company using an 8-11/32" Christensen diamond drilling bit in Natrona County, Wyoming. After 28 days rotating on bottom the bit was pulled at approximately 16,000 feet and found to be in fair condition. The operating company estimated that 35 round trips and 35 conventional bits would have been needed to drill the same intervals and that the diamond bit saved 18 days.

The bit operated under 10,000 to 16,000 pounds of weight at 53 to 57 R.P.M. The drill string consisted of 4-1/2" drill pipe, nine 7" collars with a set of jars. A second diamond bit had no trouble reaching bottom and ran for 16 rotating days, also surpassing the old 13 day record for the area.

For "Less Cost Per Foot" drilling, contact Christensen Diamond Products Company for information about its complete line of diamond bits and core barrels.

*"Less cost per foot."*

**CHRISTENSEN DIAMOND PRODUCTS**

MAIN OFFICE AND PLANT 1937 SOUTH 2nd WEST
P. O. BOX 387 SALT LAKE CITY, UTAH

# IRIS

Talk rig modernization with your Continental-Emsco Drilling Equipment Specialist. It costs you nothing to get his advice. Modernization is a good investment to increase rig efficiency, and it may be the *shot in the arm* your operation needs for upgrading your equipment to assure oil-country acceptance.

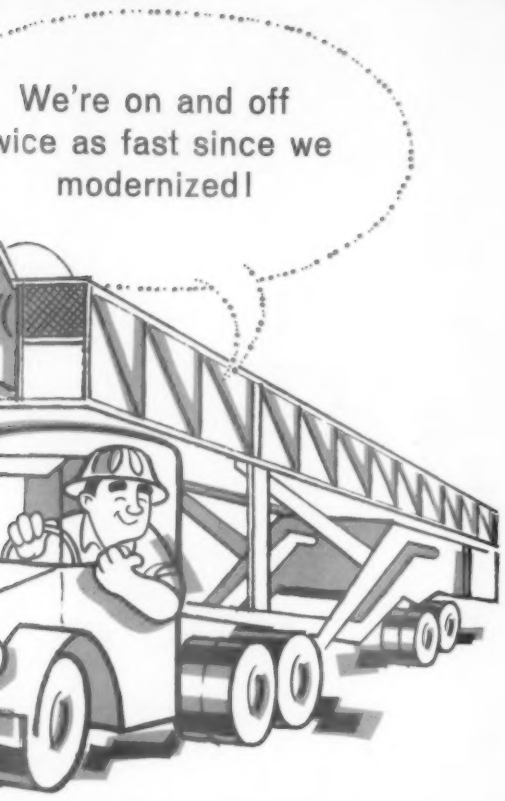
When you rely on Continental-Emsco for advice concerning rig improvement and modernization, you have the advantages of: (1) complete rig engineering assistance by personnel of a fully integrated supply company with years of experience in designing, manufacturing, applying and servicing oil-field equipment; (2) one source for all your needs; (3) engineers whose extensive knowledge can help you gain the most within your budget. Economical modernization may entail only the repair of existing equipment, or the replacement of worn or obsolete units with good used or reconditioned equipment. It may consist of more extensive replacement with new equipment, plus rearrangement for greater efficiency.

Once a plan has been formulated to meet your requirements, Continental's qualified service representatives will supervise the installation of the equipment and instruct your crews in its operation and maintenance.

# RIG MODERNIZATION BY CONTINENTAL-EM

## *Cut Excessive Maintenance Costs*

Drilling equipment in poor condition slows penetration, limits your drilling opportunities and causes you unnecessary maintenance expense . . in short, costs you money. Preventive maintenance checks by Continental-Emsco service representatives will help you keep equipment in top operating condition. Deficiencies are spotted before failure, and repairs are made when convenient. Have your rig checked soon . . reduce those costly shutdowns. It's money well spent.




## *Cut Rig-up Time.. Increase Rig Portability*

Let your Continental representative show you how fast a new, highly-portable B Series mast tears down and rigs up. They're available in four sizes from 127 ft. to 142 ft. with nominal gross capacities from 416,000 lbs. to 1,053,000 lbs... providing a complete range to meet your requirements for medium to deepest drilling.

For the optimum in portability, put your smaller rigs on wheels with a Continental-Emsco T-97 Dual Trailer Drilling Mast. With a T-97, your rig is ready to move and ready to work in the least possible time without sacrificing drilling performance. Continental-Emsco Trailerized Mud Pumps will further cut your moving time. Your Continental Drilling Equipment Specialist has other ideas to speed your rig moves .. ask him about them.

# EMSCO KEEPS COSTS DOWN.. PROFITS UP

## *Increase Penetration With Improved Hydraulics*

Frequently, your rig performance is handicapped by insufficient hydraulic capacity. This can be corrected with new or reconditioned slush pumps of larger capacity from Continental's inventory. The greater horsepower capacity required by larger pumps can be provided with a Continental power end of the size and type best suited for your requirements.

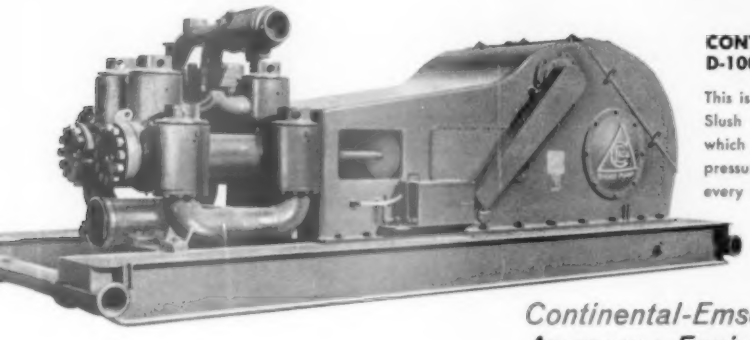
Take a look at Youngstown's light-weight drill pipe, too. Without sacrificing important hydraulic benefits, it permits you to drill deeper with your *present* drawworks.

# OPEN UP FOR LOWER DRILLING COSTS

CONTINENTAL-EMSCO

*Serving the Oil and Gas Industries ... Worldwide*

# ide Variety of Continental-Emsco Products akes Rig Modification Easy . . Less Expensive



**CONTINENTAL-EMSCO D-1000 SLUSH PUMP**

This is the largest of Continental D-Series Slush Pumps. There are six other sizes which give you a wide range of volumes, pressures and input horsepower to match every rig requirement economically.

## ntinental-Emsco Slush Pumps

e replacement of obsolete, heavy, and bulky mps with top performing Continental pumps major step in the modernization of your rig. gain the advantages of light weight, top formance, reliability, low-cost operation and uced maintenance. Continental pumps are % oil lubricated . . no grease fittings. A ented *exposed liner* design minimizes the nce of costly wash-outs and makes liners easy emove. Screw-type valve pot covers save time valve servicing. Tapered-thread piston and ension rod connections speed piston and rod vicing. These are only a few examples of the ny features that make Continental pumps your t investment for cutting hole faster . . at s cost.

## Continental-Emsco Accessory Equipment and Supplies

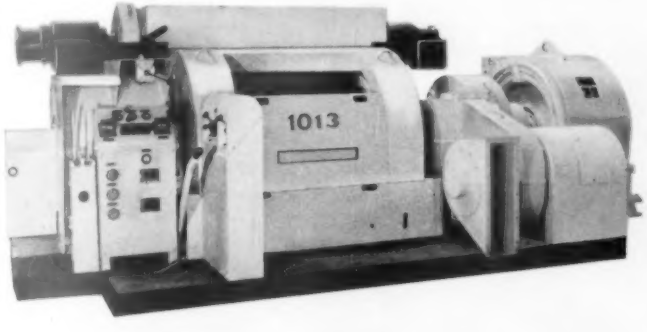
In addition to machinery, your nearby Continental store carries a full line of drilling accessories and oil-field supplies. Make it a practice to drop in regularly at this one-stop source of supply. At the sign of the Green Triangle, you can always find something new to improve your operations and reduce your costs.

## Continental-Emsco B-Line Equipment

Don't overlook B-Line equipment when planning your rig improvements. Ask your Continental representative for the B-Line story, and have him show you how this complete line of drilling machinery can be used to modernize your rig. Now manufactured, distributed and serviced by Continental-Emsco, the B-Line has many advantages for upgrading your rig.

**1013 HEAVY-DUTY DRAWWORKS**

drawworks, rated at 1200 hp, is typical ontinental-Emsco's B-Line drilling equip- . . other sizes available from 300 hp 00 hp.




*Modernize with confidence . . Modernize with Continental-Emsco*

**CONTINENTAL-EMSCO**

*Serving the Oil and Gas Industries ... Worldwide*

*MAIL the coupon for latest Safety Switch Bulletin*

Square D Company, Dept. SA-130
1601 Mercer Road, Lexington, Kentucky

Please send me your latest SAFETY SWITCH BULLETIN

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

# THE ONLY COMPLETELY SAFE SAFETY SWITCH HAS VISIBLE BLADES!

## Square D gives you Safety you can See!

• The men who pull the switches will tell you what can happen when a switch, *believed* to be open —*isn't*. A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on Visible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because *Square D switches have never been out of first place in more than 50 years!*

They cost no more...why settle for less?

SQUARE D COMPANY

*wherever electricity is distributed and controlled*

# 92%

OF THE WORLD'S
OIL COMPANIES USE
**MAGCOBAR**
DRILLING MUD
PRODUCTS

All around the world it has been conclusively demonstrated that Magcobar's better-engineered drilling mud products reduce unnecessarily high drilling costs. Wherever you are, a planned Magcobar mud program can mean faster drilling rate with less down time. And at the same time, a cleaner hole, better cuttings, better logging, and better cores can result.

The benefits of a good mud program, a *planned* Magcobar mud program, are reflected in total drilling cost. These benefits can extend even to better and more production without the use of stimulants.

On your next well, reduce hole time, speed up drilling, stabilize the hole, and reduce wear and tear on drilling equipment. You'll be in good company, too, right along with the 92 per cent of the world's oil companies who use Magcobar now. And you'll be helping yourself with the better-engineered mud products of Magcobar.

Magcobar®
*Complete*
DRILLING MUD SERVICE

**DRESSER INDUSTRIES, INC.**
OIL • GAS • CHEMICAL
ELECTRONIC • INDUSTRIAL

**MAGNET COVE BARIUM CORPORATION**
Houston

*Well Done With Magcobar Technology*

## Roll out the BOWEN CASING ROLLER

## Roll out the Casing

## Roll up the Savings

Heavy costs can be incurred when production or drilling equipment is forced through, or into, a section of collapsed or dented casing. Not only could the tools be damaged severely, requiring expensive replacement, but the casing could be permanently damaged. Correcting this situation would create even more cost!
The expense created by dented or collapsed casing can be eliminated by STRAIGHTENING OUT THE PROBLEM WITH A BOWEN CASING ROLLER.

THE BOWEN CASING ROLLER is used specifically to recondition and restore buckled, collapsed or dented casing to its normal internal diameter and roundness. This is accomplished by rotating and forcing the Casing Roller downward into the damaged area. As the tool is rotated into the reduced diameter, it exerts lateral forces on the casing to restore it to its original and normal I.D.

THE BOWEN CASING ROLLER contains no small or intricate parts to be worn, broken or lost in the well. It is manufactured from special alloy steels to resist wear. The Mandrel and all Rollers are case-hardened to provide even better wear qualities.

**Demand the best — *Bowen* Casing Rollers. Complete information available upon request.**

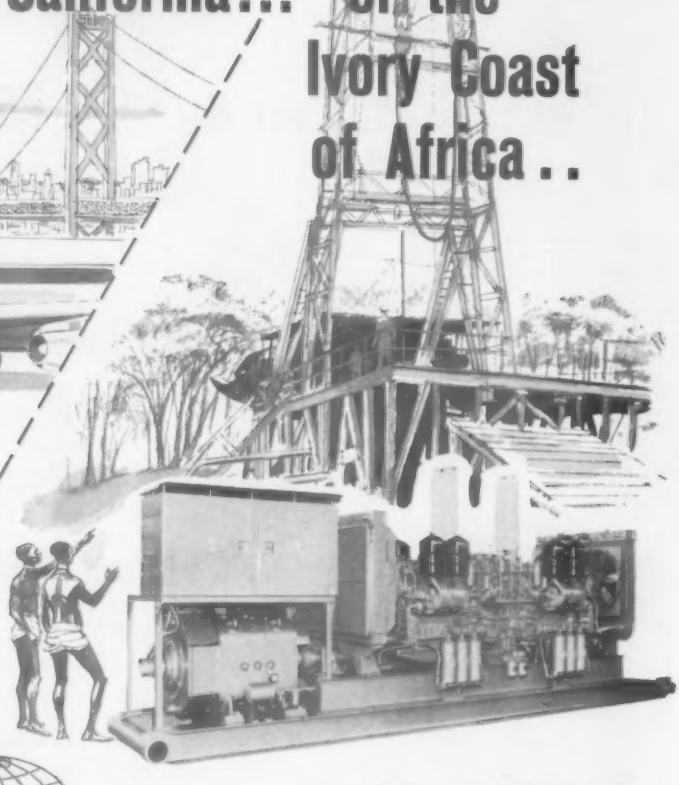
*For over 25 years—the world's leading manufacturer of fishing and specialty tools.*

BOWEN ITCO, INC.
P. O. Box 4587
Houston 13, Texas, U.S.A.
Cable Address: ITCO

BOWEN
1935 25th ANNIVERSARY 1960

# In San Francisco, California... or the Ivory Coast of Africa..

Stewart & Stevenson Self-Propelled, diesel powered, Airport Utility Unit providing electric power for a giant Boeing 707 Jet Liner.



Stewart & Stevenson RIGELECTRIC engine electric power unit supplying power for drilling operations on Laughlin Porter's oil drilling rig in Africa.

*When it comes to diesel or gas engine power, Stewart & Stevenson experience and "know-how" have no boundaries.*

Here again are two diesel engine power applications . . . in direct contrast and in opposite parts of the world . . . with one important characteristic in common: both were designed and built by Stewart & Stevenson Services, the world's largest distributor of diesel engines. Both power applications are serving vital industries where thousands of dollars and valuable contracts are totally dependent on the reliability and performance of this engine driven equipment.

When you need power . . . for any application in any part of the world . . . Stewart & Stevenson's experience, service organization and engineering will guarantee dependable performance. We will be glad to study your power needs and submit recommendations. Please write for additional information.

## STEWART & STEVENSON SERVICES, INC.

**Main Office and Plant:** 4516 Harrisburg Blvd., Houston 11, Texas
Phone CApitol 5-5341
**Branches:** Corpus Christi, Dallas, Lubbock, San Juan, San Antonio, Beaumont, Odessa
**Representatives:** Longview, Brownsville, Wichita Falls, Freeport
**Export:** Room 1405, 74 Trinity Place, New York, N. Y.

THE WORLD'S LARGEST DISTRIBUTOR OF DIESEL ENGINES

WITH NEW GENERAL ELECTRIC **SOLID-STATE** EQUIPMENT . . .

# You Achieve Greater Supervisory System Reliability

**No moving parts, no adjustments to make**—that's why you receive greater system reliability from General Electric solid-state supervisory equipment with transistorized logic elements. With these rugged new elements, which are computer-designed and factory pretested to eliminate any chance of human error, you are assured of virtually fool-proof operation.

The new solid-state plug-in logic elements eliminate malfunctions due to contact failure because there are no moving contacts. Switching and coding functions are accomplished by transistors and diodes.

**For added dependability** the solid-state unit uses a self-contained 12-volt power supply and regulator. Shock hazard in the solid-state unit is virtually eliminated, and you need no external battery supply. Transistorized elements are protected from accidental overvoltage, too.

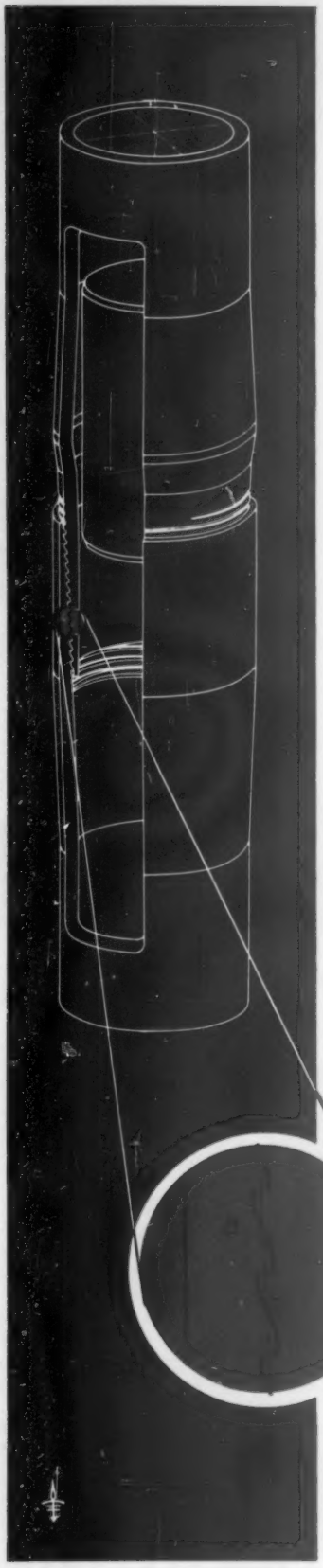
All external connections to the unit are isolated electrically so that overvoltage trips out the external circuit before the transistors are affected. Protective isolation is one more feature that assures you of system reliability.

New General Electric solid-state supervisory equipment retains the proven space-code-selector type of operation. This space-code system, developed by General Electric, has demonstrated its superiority in over 16 years of successful operation.

Get all the facts. Contact your nearest G-E Apparatus Sales Office, or write for bulletin GEA-7043, General Electric Co., Schenectady 5, N. Y. 513-10

*Progress Is Our Most Important Product*

GENERAL ELECTRIC



## Omega Joints for Casing and Tubing

- **Smaller borehole diameter**
- **Quicker assembly**
- **Faster casing off**

Our tests have proved:
No weak spots in casing and tubing lines with Omega joints.

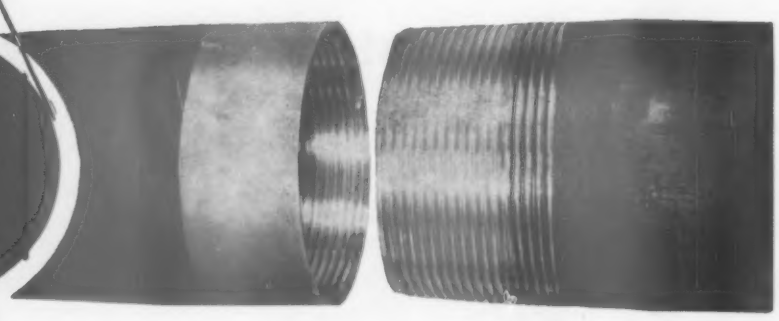
Please ask for our Prospectus No. 0597

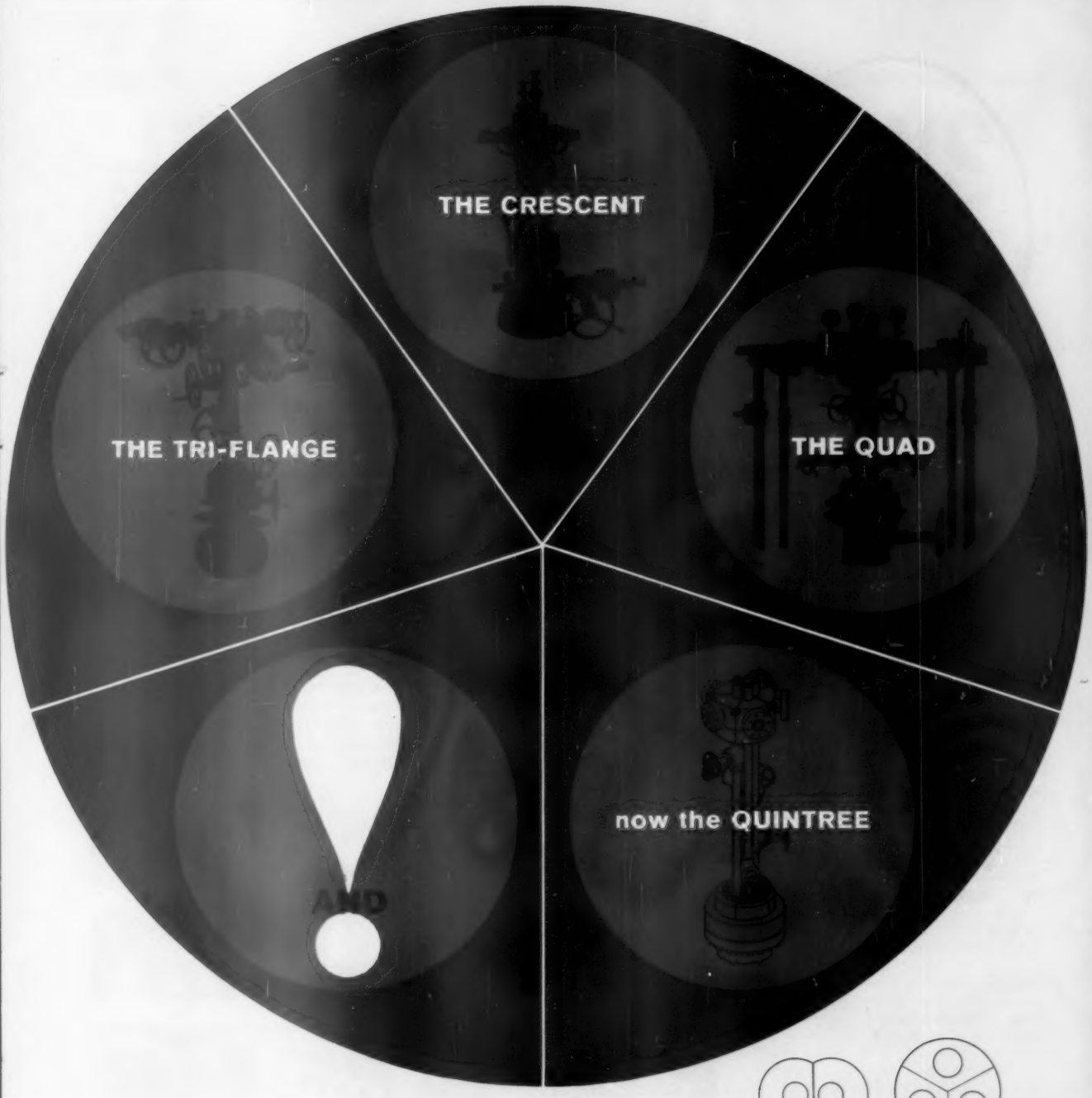
Our technical staff will be glad to advise you.

**PHOENIX-RHEINROHR AG**

VEREINIGTE HÜTTEN- UND RÖHRENWERKE DÜSSELDORF

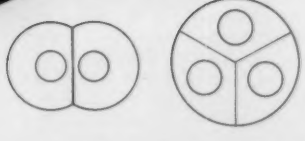
Representative in USA:
Phoenix-Rheinrohr Corporation, 20 East 46 th Street, New York N. Y. 17






## *A Tree to Solve Your Every Multiple Problem*

When at last you have grown weary of the equipment "jumble" that complicates your multiple-zone completions, take shelter under an O-C-T tree. The O-C-T label is a guarantee of simplicity, economy and durability. Examine, if you will, the QUAD TREE and the QUINTREE. With these hookups, four and five zones can be flowed through as many parallel strings. The same outstanding features that characterize the O-C-T Crescent Flange Tree and Tri Flanged Tree are incorporated. This means you can remove any valve or combination of valves without disturbing the remaining valves. The oil industry has asked for *flexibility*. This is it. For example, with this tree arrangement any combination of zones can be flowed or pumped. Crescent, Tri Flanged, Quad Trees and Quintrees are prime examples of how O-C-T stays abreast of needs for efficient multiple producer equipment. Call the O-C-T representative nearest you for further details. You'll be glad you did.



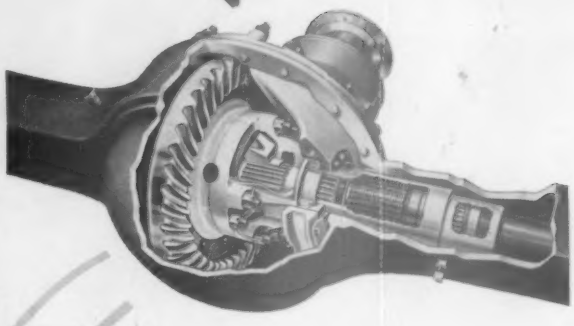
*where progress is a daily practice*

**O·C·T**

**OIL CENTER TOOL CO.**

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to
P. O. Box 3091, Houston, Texas.



# Rockwell-Standard® Traction Equalizer... puts action where there's traction!

The Rockwell-Standard Traction Equalizer provides a substantial increase in tractive effort to the wheel with the best road adhesion. It is effective on a vehicle even if one pair of driving wheels has no traction. Provides safer, surer performance on or off the highway . . . easier control on curves, slippery pavement and soft ground. Eliminates tendency of vehicle to swerve when one wheel suddenly loses traction.

**Automatic actuation.** Doesn't depend on driver to start it working. Whenever one wheel tends to turn faster than the other, Traction Equalizer starts to work.

**Tailored to your needs.** With multi-drive axle vehicles, each axle may be equipped with Traction Equalizer units. No matter where your vehicles operate—on or off the highway—the Rockwell-Standard Traction Equalizer gives your vehicles better traction.

**Self lubricating.** Traction Equalizer automatically picks up standard axle lubricant and works it through unit.

**Less maintenance.** Normally, Traction Equalizer requires no maintenance between axle overhaul periods. It also cushions impact of heavy loads on tires, shafts and gears.

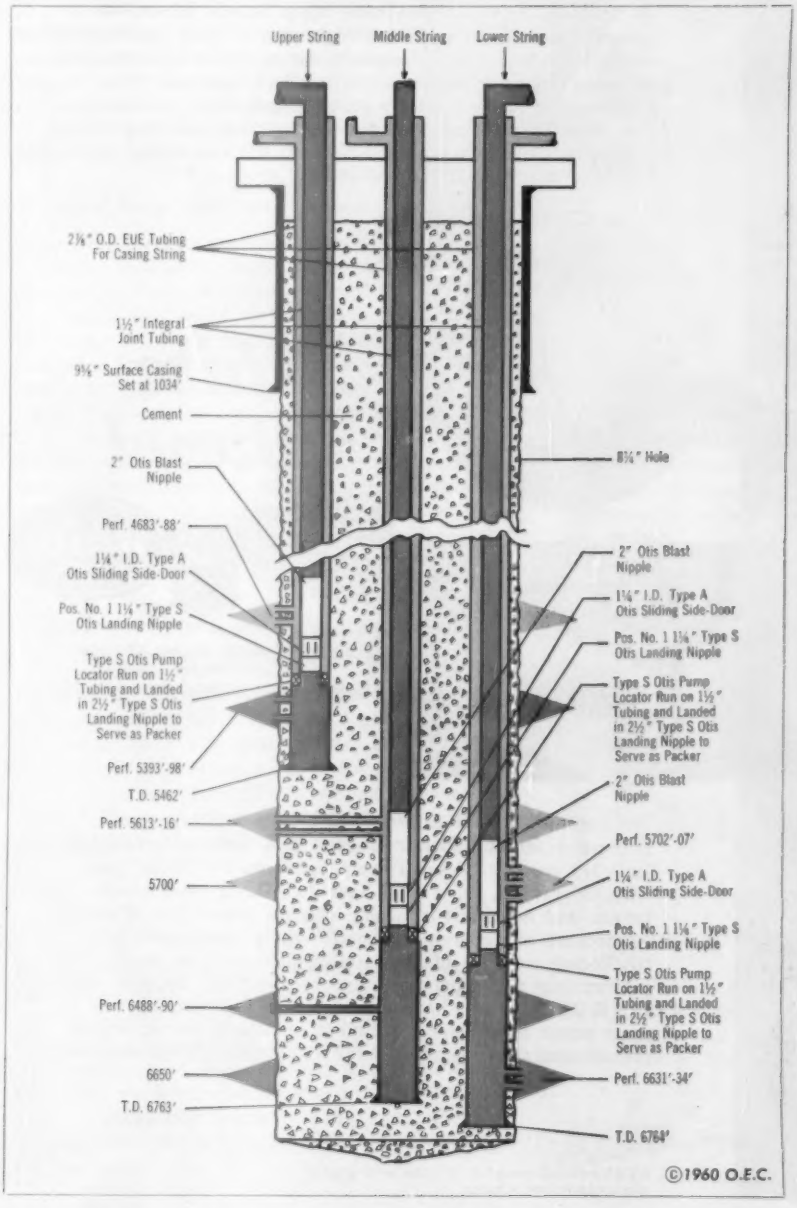
*Another Product of...* **ROCKWELL-STANDARD CORPORATION**

Transmission and Axle Division, Detroit 32, Michigan

# OTIS PRODUCTION NEWS

*Volume I, Number 4* **Otis Engineering Corporation • Dallas** *Production Equipment and Services*


# Otis Equipment Used Exclusively Below Tree in SUNRAY Sextuplet


Upper String
Middle String
Lower String
2⅛" O.D. EUE Tubing For Casing String
1½" Integral Joint Tubing
9¼" Surface Casing Set at 1034'
Cement
2" Otis Blast Nipple
Perf. 4683'-88'
1¼" I.D. Type A Otis Sliding Side-Door
Pos. No. 1 1¼" Type S Otis Landing Nipple
Type S Otis Pump Locator Run on 1½" Tubing and Landed in 2½" Type S Otis Landing Nipple to Serve as Packer
Perf. 5393'-98'
T.D. 5462'
Perf. 5613'-16'
5700'
Perf. 6488'-90'
6650'
T.D. 6763'
8¾" Hole
2" Otis Blast Nipple
1¼" I.D. Type A Otis Sliding Side-Door
Pos. No. 1 1¼" Type S Otis Landing Nipple
Type S Otis Pump Locator Run on 1½" Tubing and Landed in 2½" Type S Otis Landing Nipple to Serve as Packer
2" Otis Blast Nipple
Perf. 5702'-07'
1¼" I.D. Type A Otis Sliding Side-Door
Pos. No. 1 1¼" Type S Otis Landing Nipple
Type S Otis Pump Locator Run on 1½" Tubing and Landed in 2½" Type S Otis Landing Nipple to Serve as Packer
Perf. 6631'-34'
T.D. 6764'
©1960 O.E.C.

CORPUS CHRISTI – Except for the tubing, all sub-surface production equipment used in the world's first sextuplet producer is standard Otis equipment. And the amount of Otis equipment used in this unique completion is surprisingly small in number and total cost; for example: Only two selective Type S Otis Landing Nipples, one Type S Otis Pump Locator which serves as a packer, one Type A Otis Sliding Side-Door®, and one Otis Blast Nipple were required for each two zones completed. The identical equipment was installed in each of the three strings of 2⅛-inch tubing to permit the six zones to be produced simultaneously and economically.

Otis is the only company which has available a complete range of small diameter sub-surface production equipment to help today's aggressive producing companies complete their slim hole and tubingless wells in the simplest manner. Otis Sub-surface Safety Valves, Sliding Side-Doors, Concentric Gas Lift Valves, Plugs, Plug Chokes, Pack-off Assemblies, and time proven wire line tools make it possible to complete as many zones as practical in the deeper, multi-zone wells being drilled today.

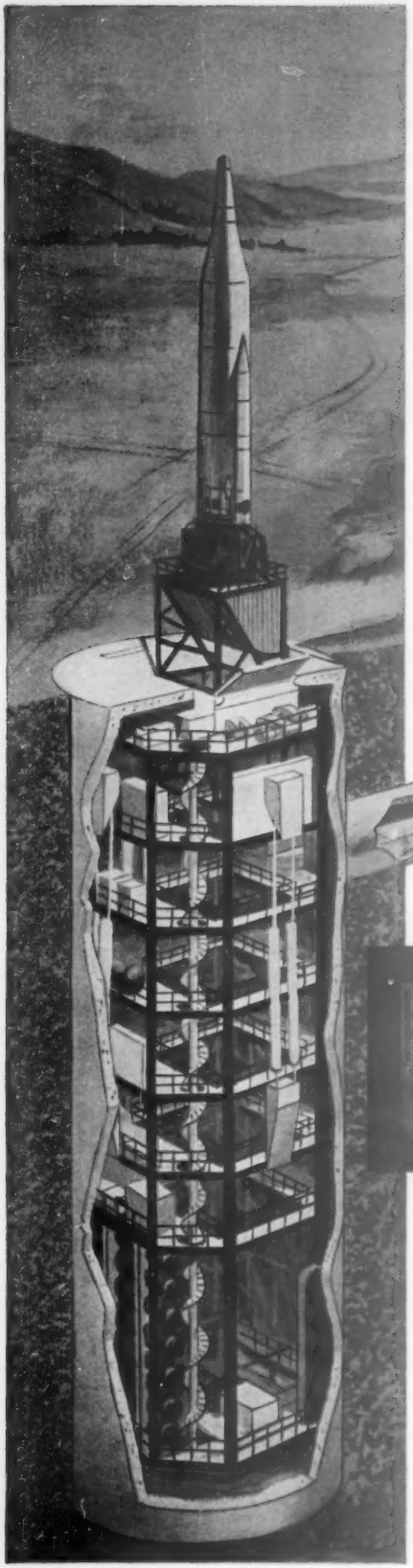
Otis Completion Specialists are available twenty-four hours a day to counsel with you on any specific completion problem. These men are expert in their field and backed up by the complete engineering and development laboratories in the Otis Dallas plant. For complete information on Otis sub-surface production equipment to be used in slim hole and tubingless completions, call the Otis office nearest you or write Otis, Dept. 4-P, Box 35206, Dallas 35, Texas. You'll find experienced Otis Well Completion Specialists ready to help you – anxious to serve you.


**OTIS**

**Engineering OTIS Corporation**

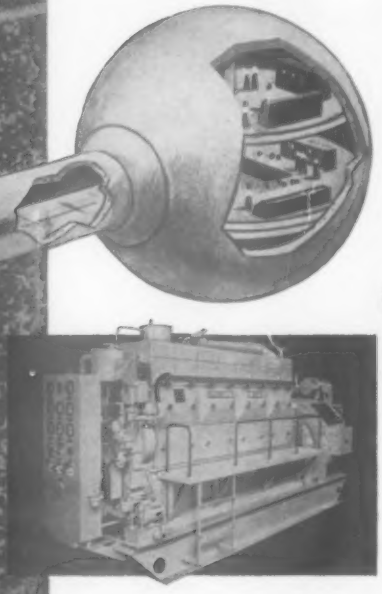
**General Offices:**

**6612 Denton Drive • Dallas, Texas**



# WHITE SUPERIOR ENGINES selected for ATLAS launching sites!

At USAF Atlas launching sites throughout the United States, prime and standby power will be supplied by White Superior engines! The Army Corps of Engineers, Kansas City, Missouri, has purchased 149 eight-cylinder supercharged Model 40 Superiors, each driving a 500 KW generator. These engine-generator sets will produce precise frequency for operation of computers and other electronic equipment. Six of the 13 planned Atlas ICBM squadrons will feature underground silo-type launching sites. Here an additional task for the Superiors will be powering elevator machinery to lift the 120-ton ICBM's to ground level, after they have been fueled and checked out down under.



White Diesel

Superior ENGINES ATLAS Imperial DIESEL ENGINES White DIESEL

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
*Plant and General Offices: Springfield, Ohio*

The contract for 149 Superiors highlights a growing and impressive list of Superior-powered U.S. defense installations. Included are the "Texas Towers," portions of "DEW" line and "SAGE" project, Eglin Gulf Test Range and other missile tracking ranges, and numerous launching sites for other types of missiles. Acceptance of Superior engines for these assignments is convincing evidence of their rugged dependability, trouble-free performance and economical fuel consumption. Superior engines—215 to 2150 HP or 150 to 1500 KW—will also meet your exact power requirements, including automatic, unattended or remote controlled operation. Write for complete information today!

*USAF artist's conception of Atlas underground silo for launching missiles*

# Instrument Monitors Corrosion Rates While Equipment Stays on Line

## Fastest Known Corrosion Rate Measurement

The *Corrosometer* is its name. It proves the effectiveness of Nalco refinery stream corrosion inhibitors . . . in a hurry. It is the fastest known method of determining corrosion rates in operating equipment; manufactured by Crest Instrument Co. under license from Standard Oil Company (Indiana), and distributed worldwide, by Nalco.

Corrosometer readings are taken quickly and accurately, indoors or out. Instrument leads are attached to probes mounted in corrosion trouble spots. One instrument serves virtually any number of probes.

### Coupons, Inspections are Slower

Determining corrosion rates by loss-in-weight methods, using coupons inserted in lines, is a much slower process. Valuable in determining average corrosion rates, it lacks the speed that enables the Corrosometer to reveal immediately any change in corrosion rate caused by process variations. Nalco Representatives, as well as Nalco Corrosion Inhibitor customers and prospects, welcome the speed with which the Corrosometer delivers accurate corrosion rate readings as a real contribution to time and money-saving establishment of good corrosion control practices.

### Corrosometer Can Show Day-to-Day Corrosion Rates in System

Readings taken with the Corrosometer show the corrosion rate in the system for a predetermined interval of time. The interval may be as long as desired—or as short as a day or less. Thus checks of Nalco treatment effectiveness, as well as prompt detection of unexpected increases in corrosivity, are practical and accurate with the Corrosometer.

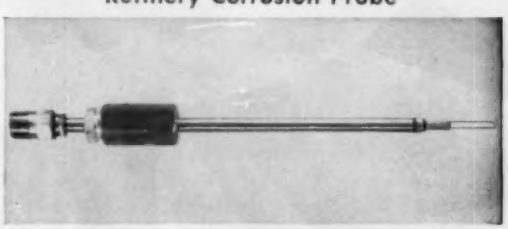
### How Corrosometer Works . . .

Utilizing the Kelvin electrical bridge circuit, the Corrosometer compares resistances of two similar probes: one protected from corrosion, the other directly in contact with the liquid or gas in the equipment under test. Corrosion of the unprotected probe increases its electrical resistance, and the difference between probe resistances is directly convertible to corrosion-rate readings of high accuracy.

Retractable probes, for easy replacement without shutting down the system, and probes for high temperature and high pressure systems make the Corrosometer a valuable tool in checking Nalco Results in all types of corrosion-prone equipment.

Your Nalco Representative can give you full details on both the Corrosometer and Nalco corrosion inhibitors. Call him today — or write for descriptive literature.

### Refinery Corrosion Probe



Retractable probe can be installed through a gate valve; replaced quickly without taking equipment off line.

*National Aluminate Corporation is now*

**NALCO CHEMICAL COMPANY**

6242 West 66th Place • Chicago 38, Illinois

*Subsidiaries in England, Italy, Mexico, Spain, Venezuela and West Germany*

*In Canada—Alchem Limited, Burlington, Ontario*

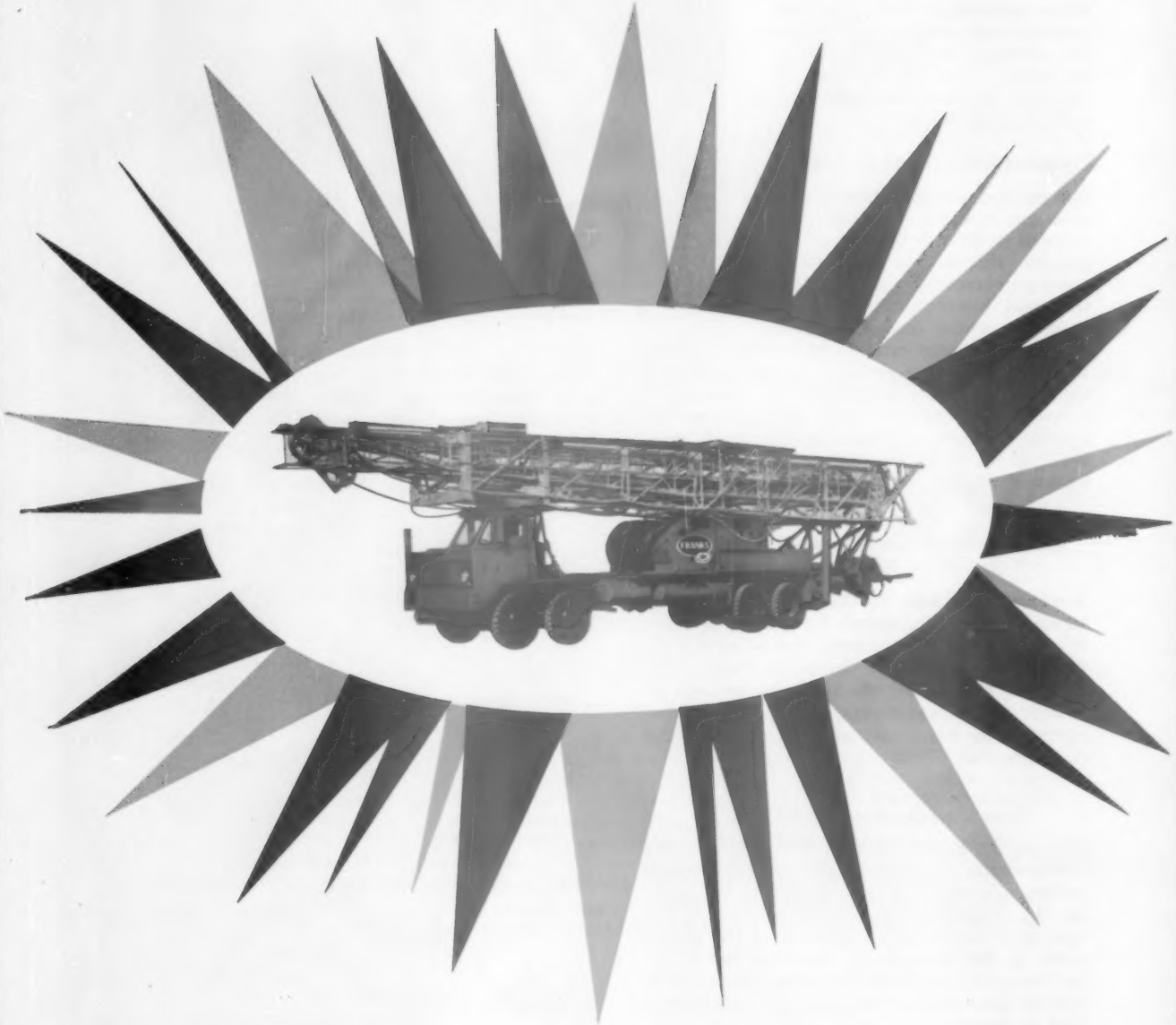
Nalco® *Serving Industry through Practical Applied Science*

Nalco CHEMICALS

FRANKS

# EXPLORER

*Rocket*



# WORTH MORE WHEN YOU BUY IT!
# WORTH MORE WHEN YOU TRADE IT!

Common sense will tell you that there is a difference in most things despite the tendency to imitate the leader. There's a difference in baseball players . . . in cooks . . . yes, even in oil well servicing units . . . although competitive units are getting to look mighty like the Franks Explorer.

Now, this **difference** is what keeps the Franks Explorer ahead of the pack. It's the difference which makes superintendents prefer Franks units on their jobs. It's the difference you feel in your pocketbook when you trade it in. The higher resale value of Franks Explorers speaks louder of this difference than any words we can dream up.

Ask the man who uses Franks!

## "WORTH MORE" FEATURES

- Industrial high torque power with plenty of reserve
- Rugged duty drums . . . flanges won't spread
- Safety-view controls
- Complete package service on entire unit
- True rated capacity derricks . . . 100,000 to 275,000#
- No sag . . . no bend frame
- Safe front and rear rocker beam axle suspension
- Service proven hydratarder brakes with patented derrick tank to give maximum cooling for deepest wells
- More usable power

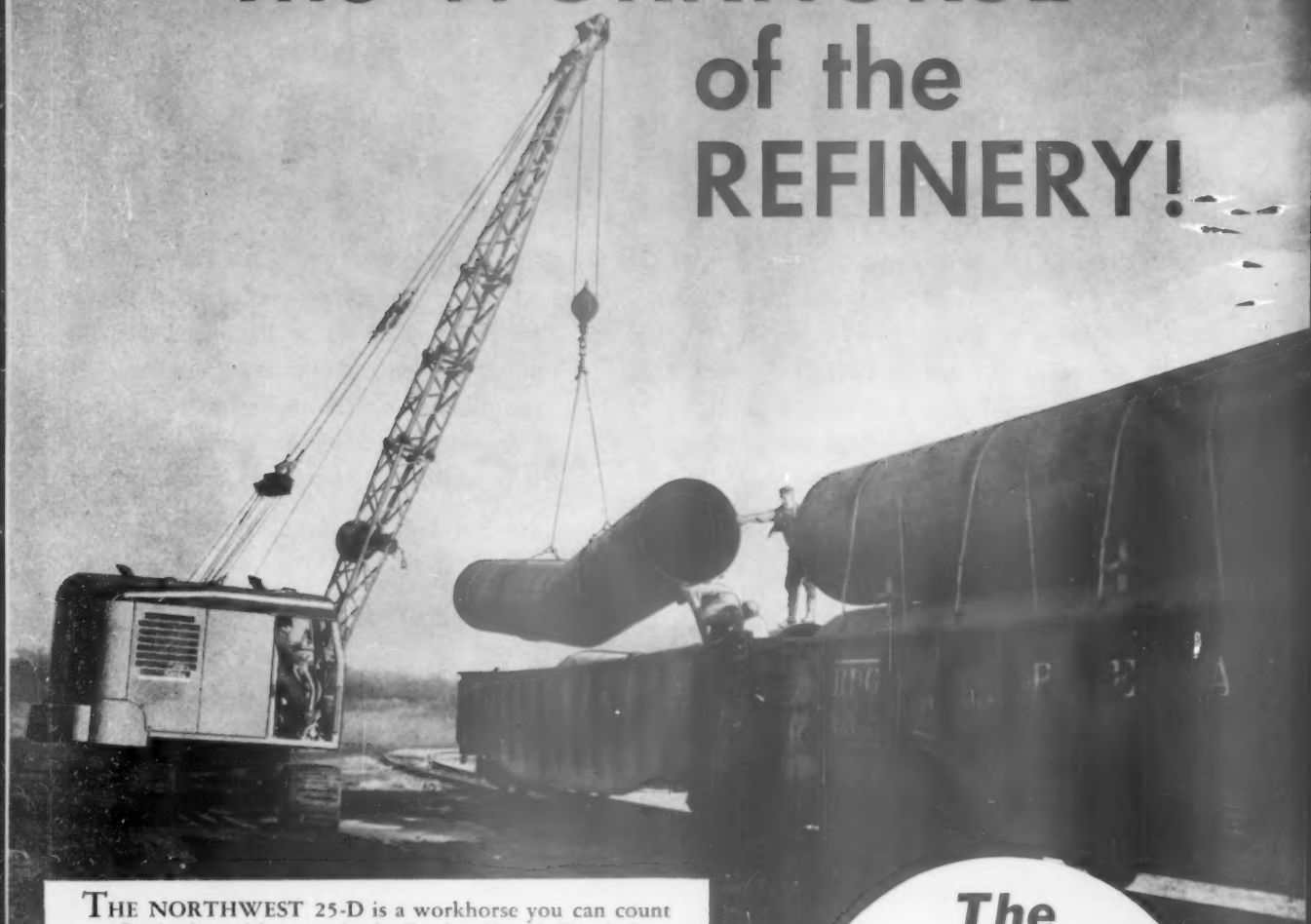
*ON THE SPOT . . . 'ROUND THE CLOCK . . . FIELD SERVICE*

**And, Franks Unexcelled Factory Service the World Over Makes the Franks Explorer Worth More While You Have It!**

WELL SERVICING AND DRILLING UNITS
FRANKS
DIVISION OF
CABOT SHOPS, INC.
PAMPA, TEXAS

***. . . manufacturers of the most imitated units in the field today!***

# The WORKHORSE of the REFINERY!



THE NORTHWEST 25-D is a workhorse you can count on. Beginning with controls, the Feather-Touch Clutch Control gives you the accuracy and feel of the load necessary for almost micromatic placement in spotting a load, setting a valve or pipe, particularly where a high lift in a maze of structures is the problem. The velvet action of the larger Uniform Pressure Swing Clutches eliminates the jerks and grabs often characteristic of band-type design. Northwest Uniform Pressure Swing Clutches will run hour after hour and give trouble-free service without blowers or boosters.

You have boom hoist equipment unequaled for ruggedness on any other machine. The Northwest Independent High-Speed Worm Boom Hoist operates through Uniform Pressure Clutches under power both up and down. A spring loaded auxiliary brake automatically releases when raising or lowering the boom and the boom can be locked in a fixed position when desired. Positive Power Load Lowering provides positive operation with a single lever control in conjunction with the right-hand drum clutch. It can be engaged or disengaged at will, either free or under load. There is no backlash and a Uniform Pressure Clutch assures smooth action.

When a third hoist line is required a 3rd drum becomes part of the equipment and, with a dragline Fair-Lead in place, you have the ability to move from pile driving equipment with live leads to dragline operation.

Every feature you need is available for any crane job and the standard 25-D is supplemented by a 25-D, 18-ton Lifting Crane.

Get the full details on this able workhorse. It has been proved on miles of pipeline work.

**NORTHWEST ENGINEERING COMPANY**
**1513 Field Building, 135 South La Salle Street, Chicago 3, Illinois**

**The NORTHWEST 25-D**

*"THEY'RE ALWAYS READY TO GO!" You can say...*

CRANES
SHOVELS
DRAGLINES
PULLSHOVELS
TRUCK CRANES

NORTHWEST

*a christmas tree is only as strong as its weakest seal*

# Rector makes the hook-up that is Sealed with Steel throughout

Rector wellhead equipment is designed to insure a leak-proof seal at all connections. Compare Rector's metal-to-metal seal features with any equipment on the market using resilient packing between casing and tubing strings. The Rector principle of reinforcing temporary organic packing with a permanent ring of steel insures a positive leak-proof completion every time. Rector's built-in welding ring coupled with an API ring gasket is easy to install, immune to corrosion inhibitors, will not flow under high pressure or temperature, will not freeze or contract under low temperature, will not burn out, and never requires maintenance or replacement.

There are no weak links in your completions, when you specify Rector equipment at your favorite supply store, or from your Rector representative.

30 YEARS MAKING THE OIL INDUSTRY SAFER

**Rector**

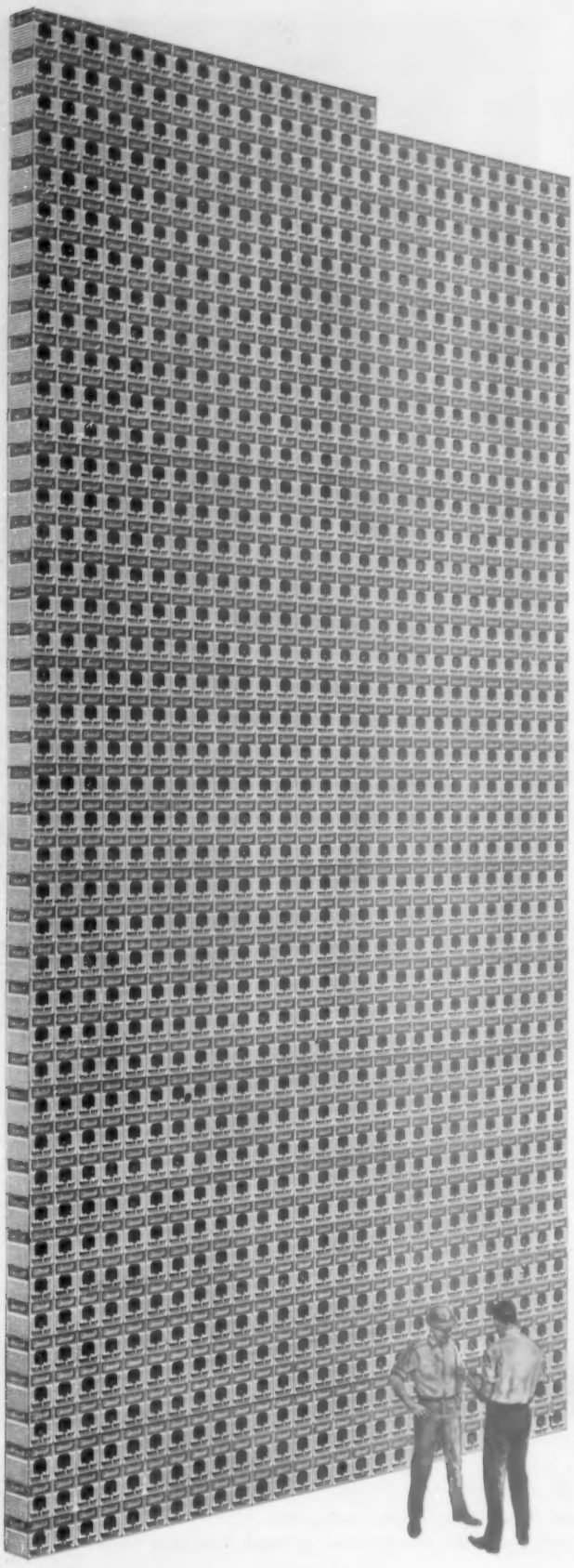
**Well Equipment Co., Inc.**

*Making the Oil Industry Safer!*

MONOGRAMMED EQUIPMENT

**1100 North Commerce, Fort Worth, Texas Houston Plant: 2215 Commerce Street**

**EXPORT REPRESENTATIVES: Continental-Emsco Co., Mid-Continent Supply Co., Oilwell Division of United States Steel Corporation**



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# 1150

## types, sizes and variations of rugged, dependable rock bits

To assure THE RIGHT BIT for every job, Security produces a total of 1150 different rock bits of proven quality. They are the product of outstanding industrial teamwork between imaginative designers, intelligent engineers and specially-skilled craftsmen schooled in advanced manufacturing techniques, operating latest precision production equipment. Add Security's prompt rigside service plus aid on particularly sticky drilling problems from seasoned field engineers. The total result: You get *more* from Security!

*Write for new 1960-1961 All-Products Catalog.*

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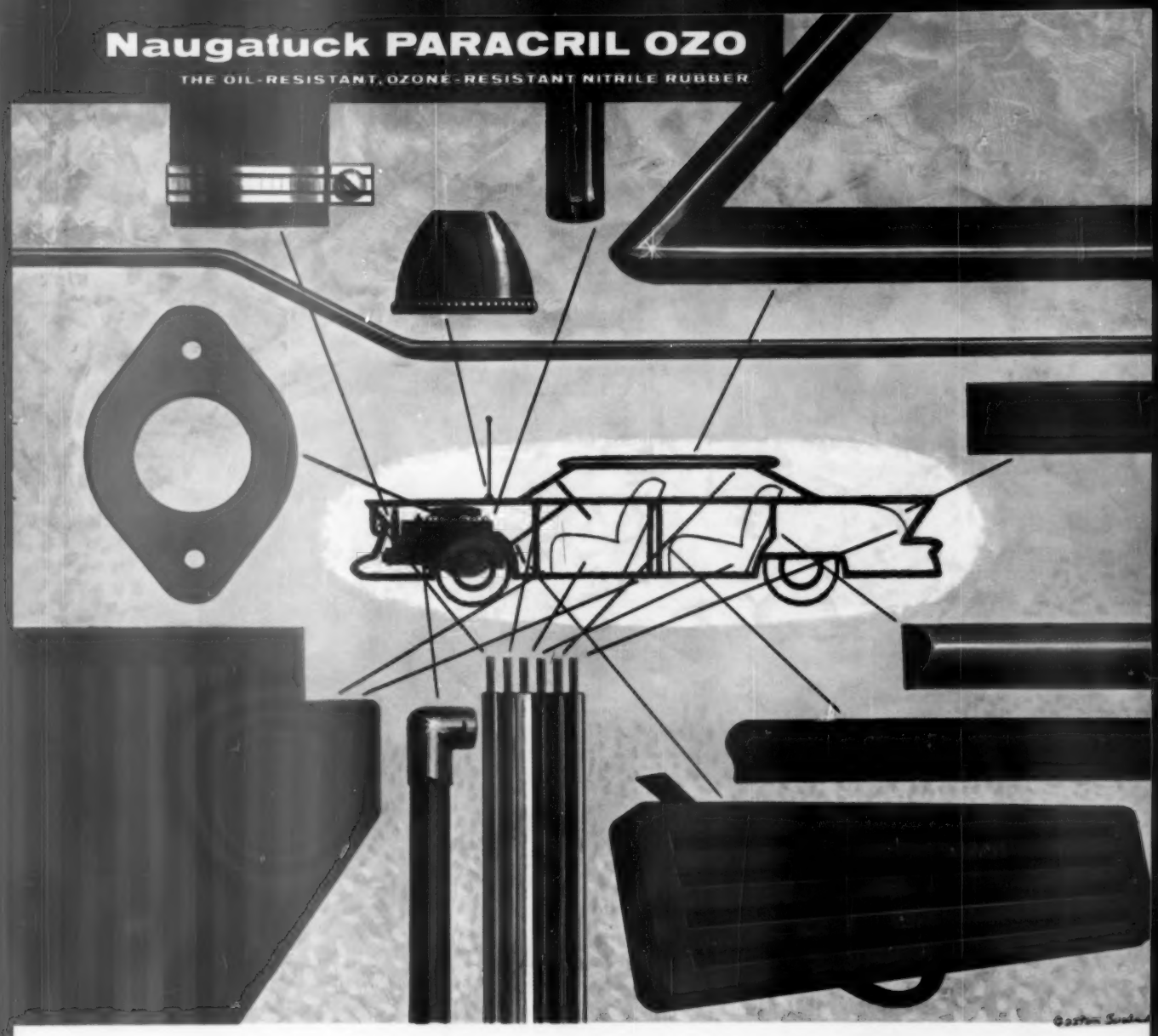
# Naugatuck PARACRIL OZO

THE OIL-RESISTANT, OZONE-RESISTANT NITRILE RUBBER



## Great new advance in automotive rubber

Here is a new rubber that's unmatched for oil, weather, and abrasion resistance. It's new PARACRIL® OZO, the finest achievement yet in the nitrile rubber field. PARACRIL OZO's properties are tailor made for many modern automotive parts—for everything from weather stripping to oil seals and hose. PARACRIL OZO gives you a whole series of important advantages, including:

- significantly superior ozone resistance
- excellent fuel and oil resistance
- several times greater abrasion resistance
- permanent retention of bright colors for exterior styling and easily traceable wiring and other interior parts

Look into PARACRIL OZO. Discover for yourself its new design possibilities...its unlimited color...its high quality. Contact your nearest Naugatuck representative at the address below.

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**Division of United States Rubber Company** Dept. A Elm Street Naugatuck, Connecticut

US RUBBER

Rubber Chemicals · Synthetic Rubber · Plastics · Agricultural Chemicals · Reclaimed Rubber · Latices · CANADA: Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ontario · CABLE: Rubexport, N.Y.

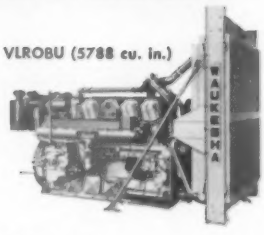
# *When you need a gas engine... buy a*

# WAUKESHA "designed for gas" ENGINE

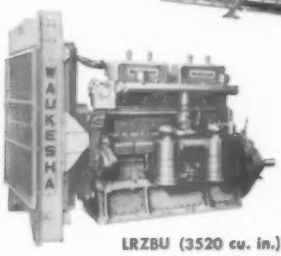
Need a gas engine? How can you pick a gas engine that's "tailor-made" for your needs? Get a Waukesha *designed-for-gas* engine! Then you can be sure—before you buy. Why? The Waukesha gas engine line is *complete.* You can get *exactly* the right engine to meet your needs. The Waukesha combination of *designed-for-gas—and* built-for-gas construction features, and first-quality materials—with low fuel and lubrication costs—is the result of over fifty years' experience in building fine engines. In oil fields all over the world *Waukesha* is the word and the buy-word for *dependable* full rated horsepower on gas fuel.

**WAUKESHA MOTOR COMPANY**
**Waukesha, Wisconsin**
New York • Tulsa • Los Angeles
Factories: Waukesha, Wisconsin and Clinton, Iowa

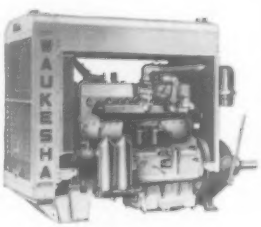
LOOK at this complete line of WAUKESHA *designed-for-gas* engines. Send for literature.



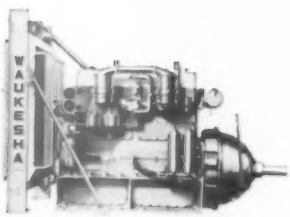
VLROBU (5788 cu. in.)



LRZBU (3520 cu. in.)



WAKCU (1197 cu. in.)



NKRBU (1905 cu. in.)

496-R

The ratings below are for standard engines without power consuming accessories

| MEDIUM NATURAL GAS ENGINES | | | | | 800 | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 | 2200 | 2400 | 2600 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ICK | 4-A | 2½x3⅛ | 61 | 36-1600 | 5 | 6 | 8 | 9 | 11 | 12 | 14 | 15 | 16 | |
| FC | 4-Ir | 3¼x4 | 133 | 88-1200 | 12 | 16 | 20 | 23 | 26 | 28 | 30 | 31 | 31 | 31 |
| 180-GKB | 4-AC | 3⅜x3¾ | 155 | 112-1400 | 15 | 20 | 25 | 30 | 34 | 37 | 39 | 42 | 43 | |
| XAH | 4-Ir | 3⅜x4½ | 186 | 120-1400 | 16 | 22 | 27 | 32 | 36 | 39 | 42 | 42 | | |
| 190-GLB | 6-A | 3¾x4 | 265 | 192-1200 | 29 | 36 | 44 | 50 | 57 | 62 | 66 | 67 | 67 | |
| 195-GL | 6-A | 4 x4 | 302 | 214-1200 | 32 | 40 | 49 | 57 | 63 | 68 | 72 | 75 | 76 | |
| 195-GK | 6-A | 4⅛x4 | 320 | 217-1400 | 32 | 40 | 49 | 58 | 66 | 74 | 80 | 87 | 93 | |
| 135-GZ | 6-A | 4⅜x5 | 451 | 315-1200 | 48 | 60 | 72 | 83 | 93 | 103 | 112 | 118 | 122 | |
| 135-GZ | 6-AV | 4⅜x5 | 451 | 315-1200 | 48 | 60 | 72 | 83 | 93 | 103 | 112 | 118 | 122 | |
| 140-GZ | 6-A | 4⅜x5½ | 554 | 395-1000 | 60 | 75 | 90 | 104 | 116 | 127 | 136 | 144 | 149 | |
| 140-GZ | 6-AV | 4⅜x5½ | 554 | 395-1000 | 60 | 75 | 90 | 104 | 116 | 127 | 136 | 144 | 149 | |
| 140-GZ | 6-AV† | 4⅜x5½ | 554 | 453-800 | 69 | 86 | 102 | 117 | 132 | 145 | 157 | 167 | 175 | |
| 145-GZ | 6-A | 5⅜x6 | 817 | 597-800 | 91 | 113 | 135 | 155 | 174 | 191 | 205 | 219 | 230 | |
| 145-GZ | 6-AV | 5⅜x6 | 817 | 597-800 | 91 | 113 | 135 | 155 | 174 | 191 | 205 | 219 | 230 | |
| 145-GZ | 6-AV† | 5⅜x6 | 817 | 646-1000 | 98 | 123 | 147 | 170 | 193 | 214 | 233 | 249 | 264 | |
| WAKC | 6-AV | 6¼x6½ | 1197 | 900-800 | 137 | 171 | 204 | 236 | 264 | 283 | | | | |
| WAKC | 6-AV† | 6¼x6½ | 1197 | 1038-800 | 158 | 193 | 226 | 258 | 288 | 315 | | | | |

| LARGE NATURAL GAS ENGINES | | | | | 600 | 700 | 800 | 900 | 1000 | 1100 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NKRB | 6-ACV | 7 x8¼ | 1905 | 1505-600 | 172 | 197 | 220 | 244 | 266 | 286 | 306 |
| NKRB | 6-ACV† | 7 x8¼ | 1905 | 1600-600 | 183 | 211 | 238 | 265 | 288 | 313 | 334 |
| LRORB | 6-ACV | 8½x8½ | 2894 | 2270-800 | 252 | 300 | 346 | 385 | 420 | 445 | 464 |
| LRORB | 6-ACV† | 8½x8½ | 2894 | 2341-800 | 260 | 310 | 357 | 402 | 443 | 478 | 508 |
| LRZB | 6-ACV | 9⅜x8½ | 3250 | 2700-800 | 305 | 357 | 409 | 450 | 485 | 515 | 537 |
| LRZB | 6-ACV† | 9⅜x8½ | 3250 | 2850-800 | 322 | 378 | 434 | 486 | 533 | 575 | 610 |
| VLROB | 12-ACV | 8½x8½ | 5788 | 4590-600 | 524 | 601 | 672 | 743 | 807 | 859 | 890 |
| VLROB | 12-ACV† | 8½x8½ | 5788 | 4985-700 | 562 | 665 | 753 | 835 | 911 | 978 | 1027 |

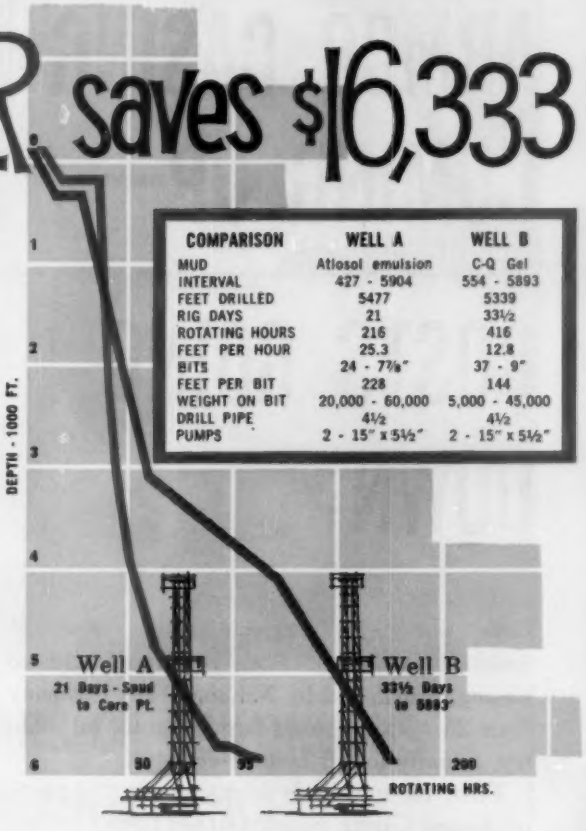
*FEATURES: 4, 6, 12—No. Cylinders; A—Aluminum Pistons; C—Counterbalanced; Ir—Cast Iron Pistons; V—Vibration Dampener.
†Special high compression ratios for higher horsepower and better economy to be fueled with dry methane type gas having a high heat value of 1150 BTU/cu. ft. or less.

# Faster Drilling-Fewer Bits

# ATLAS EMULSIFIER saves $16,333

Faster drilling on Big Horn Basin Well, Big Horn County, Wyoming, cut rig time by 12½ days and required 13 fewer bits than offset Well B . . . both contractor and operator attribute savings directly to the mud program utilizing an Atlas emulsifier. Both wells were drilled with the same size equipment and under equivalent conditions. The mud program for Well A, however, was in sharp contrast to the high-solids, high-weight, high-viscosity muds generally used in this area. Acclaimed as the best-drilled well in the area to date, Well A used a low-solids oil-in-water emulsion with an Atlas emulsifier. This low-viscosity, low water-loss fluid maintained a trouble-free open hole, brought up clean cuttings and made the savings possible . . . a total of $16,333 in rig time and bit costs.

| COMPARISON | WELL A | WELL B |
|---|---|---|
| MUD | Atlosol emulsion | C-Q Gel |
| INTERVAL | 427 - 5904 | 554 - 5893 |
| FEET DRILLED | 5477 | 5339 |
| RIG DAYS | 21 | 33½ |
| ROTATING HOURS | 216 | 416 |
| FEET PER HOUR | 25.3 | 12.8 |
| BITS | 24 - 7⅞" | 37 - 9" |
| FEET PER BIT | 228 | 144 |
| WEIGHT ON BIT | 20,000 - 60,000 | 5,000 - 45,000 |
| DRILL PIPE | 4½ | 4½ |
| PUMPS | 2 - 15" x 5½" | 2 - 15" x 5½" |



Atlas emulsifier is sold through distributors under these tradenames . . . each is the product of Aquaness Department, Atlas Powder Company:

**TRIMULSO®**
Distributed by Baroid Division, National Lead Company
Registered trademark Baroid Division, National Lead Company

**DRILLING MILK**
Distributed by Magnet Cove Barium Corporation
Registered trademark Magnet Cove Barium Corporation

**ATLOSOL**
Distributed by Milwhite Mud Sales Company and other selected mud companies
Registered trademark Atlas Powder Company

**ATLAS EMULSIFIERS IMPROVE A GOOD DRILLING FLUID**
**Because Atlas oil-in-water emulsion muds provide better oil action, they improve hole conditions, extend bit life, and increase penetration rates.**

**Better Hole Conditions.** Atlas oil emulsion decreases torque as much as 50% . . . the hole is kept cleaner and pump pressures are correspondingly lower. There is less danger in lost-circulation and low-pressure zones.

**Longer Bit Life.** Atlas oil emulsion prevents balling, provides better cutter and bearing lubrication. Greatly extended bit life reduces bit costs, reduces rig hours lost to trip time.

**Faster Drilling Rates.** Atlas oil emulsion makes more feet of hole per hour. Oil lubrication combines with improved hole condition to increase drilling rates in competent and troublesome formations.

ATLAS Aquaness CHEMICALS ATLAS POWDER COMPANY

Aquaness Department, Atlas Powder Company
P. O. Box 21072 • Houston 26, Texas

# ARMCO CASING COMING UP—

# COSTS GOING DOWN

Here's one way you can reduce costs and still get the high quality casing you require. Armco Casing, distributed by National Tank Company from 25 stocking points throughout the oil country, actually lowers costs *three ways.*

First, the uniformly high collapse resistance of Armco Casing means you set lighter strings to greater depths.

Second, Armco Casing, supplied in exact 40- or 50-foot lengths, has fewer joints in the string, resulting in faster running time.

Third, field welding costs stay down with Armco Casing. Just stab one end of a joint into the Armco Slip-Joint Collar, make a fast weld, and lower away.

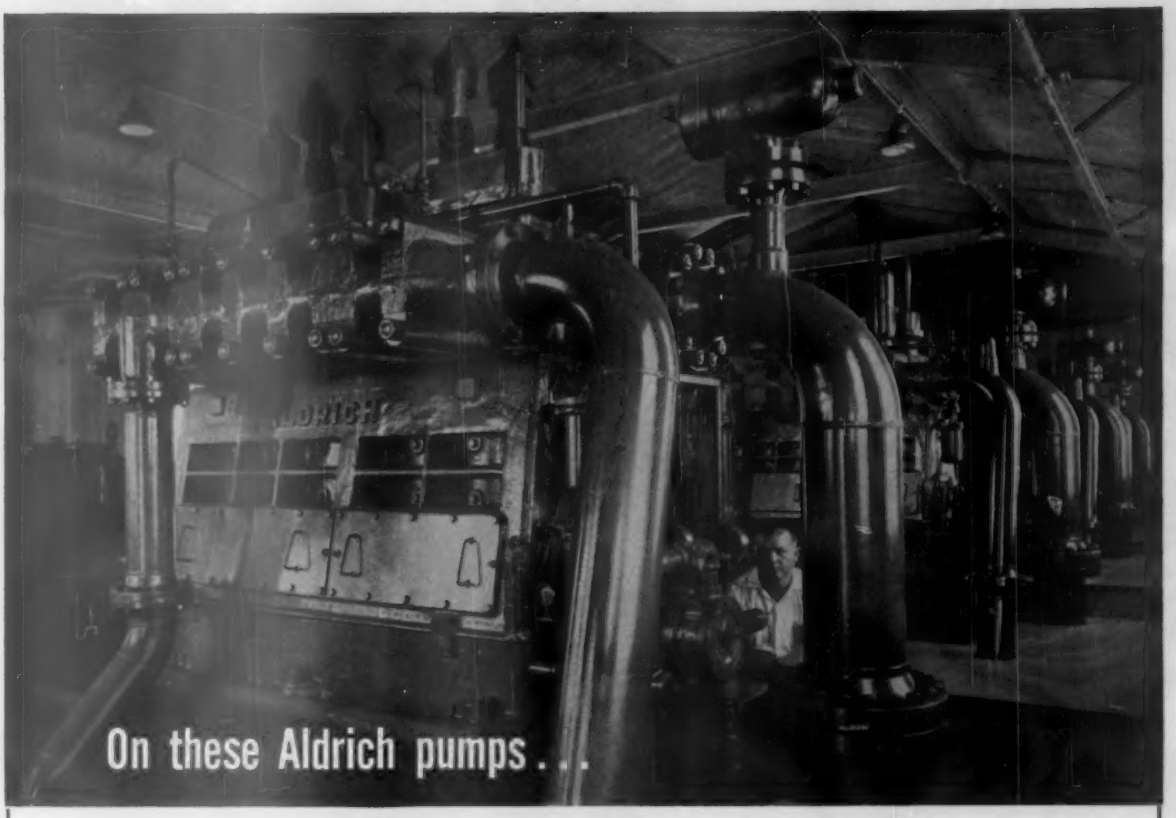
Armco Casing sizes range from 6 to 24 inches. For complete product data, write to: Armco Drainage & Metal Products, Inc., 4770 Curtis Street, Middletown, Ohio, or 201 KOME Building, Tulsa, Oklahoma.

New steels are born at Armco

**ARMCO DRAINAGE & METAL PRODUCTS**

*Subsidiary of* ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company • The Armco International Corporation • Union Wire Rope Corporation




# GULF OIL REPORTS 6 YEARS OF CONTINUOUS SERVICE WITH MINIMUM MAINTENANCE

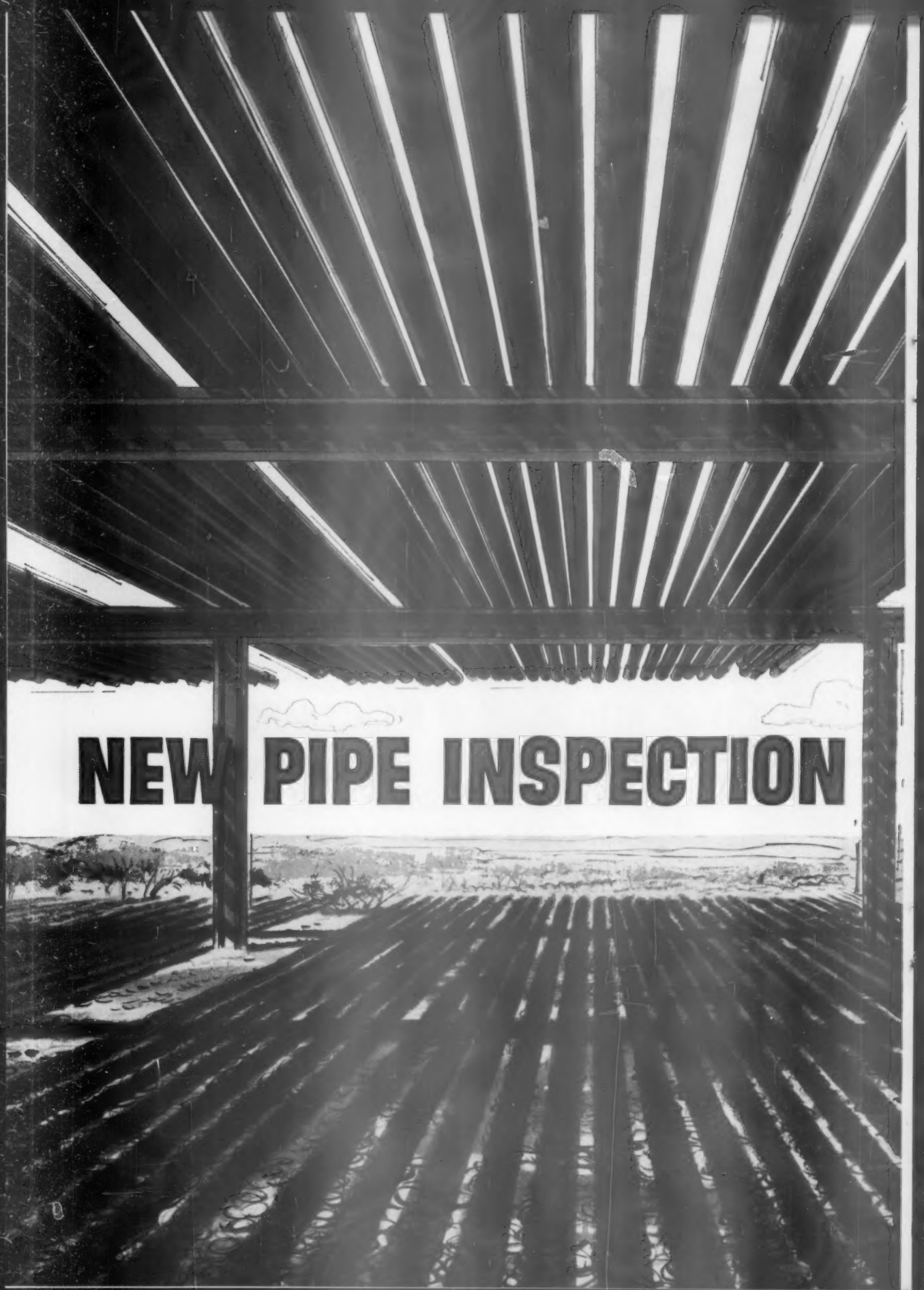
FIELD REPORT

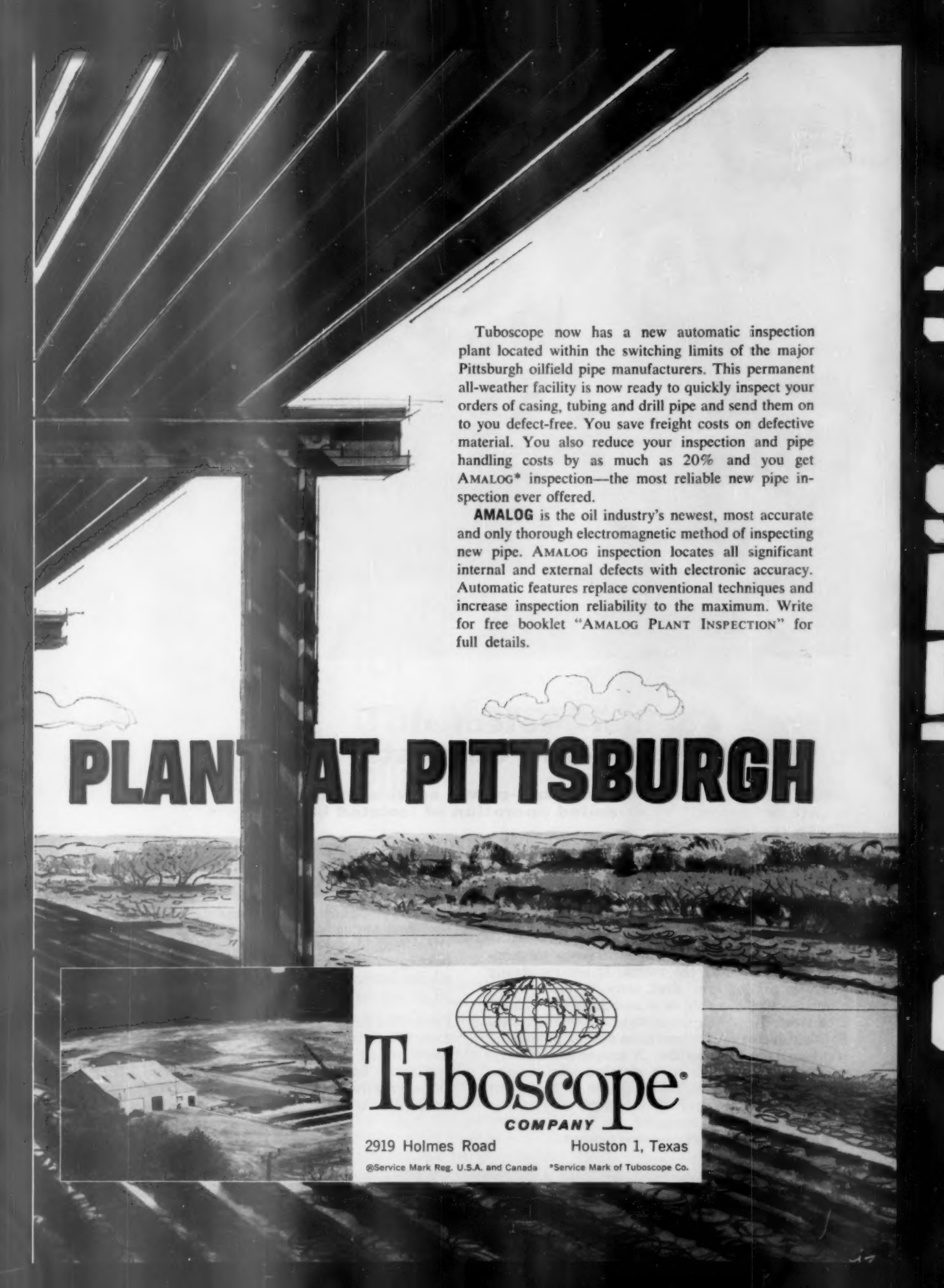
FLOOD: Goldsmith-San Andres Unit
OPERATOR: Gulf Oil Corporation
PUMPS: 4 Aldrich Quintuplex
FLOODING STARTED: October, 1954
EXPERIENCE TO DATE:

After six years, three pumps operate 24 hours a day, delivering some 54,000 bbl/day of sour oil field brine at 750 to 800 psi. Station designed for automatic operation. All maintenance handled by one man during eight-hour work day.

Field parts stock available in Carmi, Ill.; Calgary; Casper, Wyoming; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information write the ALDRICH PUMP COMPANY, 9 Gordon Street, Allentown, Pa.

*the tough pumping problems go to* ALDRICH


NEW PIPE INSPECTION



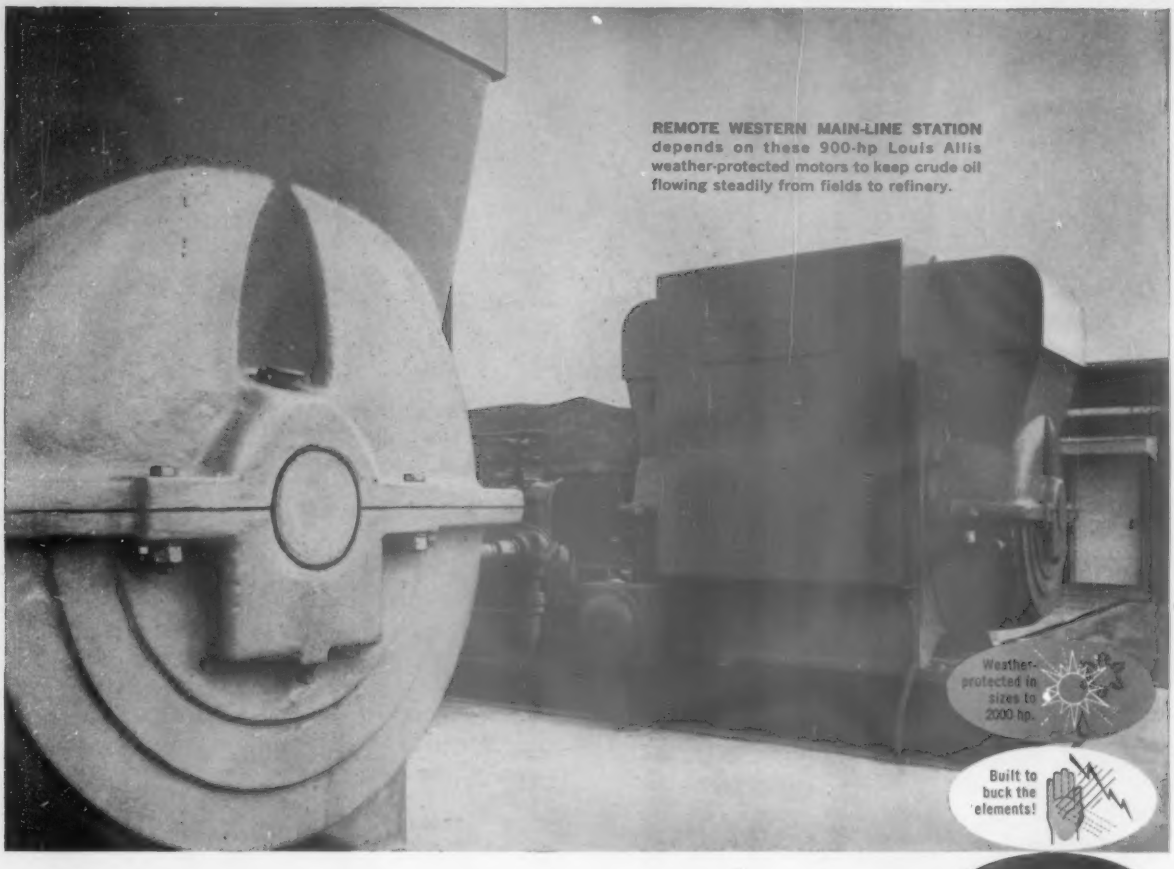
Tuboscope now has a new automatic inspection plant located within the switching limits of the major Pittsburgh oilfield pipe manufacturers. This permanent all-weather facility is now ready to quickly inspect your orders of casing, tubing and drill pipe and send them on to you defect-free. You save freight costs on defective material. You also reduce your inspection and pipe handling costs by as much as 20% and you get AMALOG* inspection—the most reliable new pipe inspection ever offered.

**AMALOG** is the oil industry's newest, most accurate and only thorough electromagnetic method of inspecting new pipe. AMALOG inspection locates all significant internal and external defects with electronic accuracy. Automatic features replace conventional techniques and increase inspection reliability to the maximum. Write for free booklet "AMALOG PLANT INSPECTION" for full details.

# PLANT AT PITTSBURGH

Tuboscope®
COMPANY
2919 Holmes Road Houston 1, Texas

®Service Mark Reg. U.S.A. and Canada *Service Mark of Tuboscope Co.


REMOTE WESTERN MAIN-LINE STATION depends on these 900-hp Louis Allis weather-protected motors to keep crude oil flowing steadily from fields to refinery.
Weather-protected in sizes to 2000 hp.
Built to buck the elements!

# Here's weather-protected power for pipe-line outposts!

**Louis Allis motors give you sure-power service in any weather—permit unattended operation of isolated installations.**

You can count on these powerful weather-protected motors for non-stop pumping of oil from the fields to refinery and on to far-flung distribution stations. You can depend on them for virtually maintenance-free operation at any outpost. A periodic spot-check is all the attention they need.

Louis Allis all-weather design prevents contaminants from entering the motor. It assures steady power in driving rain, sleet, snow, or biting sandstorms — in bitter cold or in scorching desert heat. The treated corrosion-resistant all-welded steel housing shields the top and sides against falling and wind-driven contamination. A unique low-velocity, vertical-lift air-intake with stainless steel screens slows down cooling air and prevents air-borne dirt from being sucked into the windings.

The revolutionary MYLAR-GLASS-LECTON* insulation protects windings against corrosion and moisture — provides high dielectric and mechanical strength for long, trouble-free motor operation. Strip-type space heaters eliminate condensation problems normally present in these applications. Other long-life features include split-type cast iron bearing brackets; split-sleeve bearings with dual oil-ring lubrication; a seal and vent system to keep oil in and dirt out; and an oiler and sight gauge.

Louis Allis builds weather-protected motors in sizes from 250 to 2000 hp, with modifications to fit your needs — and provides expert engineering and field application help. Contact your Louis Allis District Office, or write for Bulletins 2550 and 2600 to The Louis Allis Co., 449 E. Stewart St., Milwaukee 1, Wis.

*MYLAR and LECTON are DuPont registered trademarks.

**LOUIS ALLIS**

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

*Transformer oils get a new lease on life with DBPC® antioxidant*

Transformer insulating oils inhibited with DBPC® antioxidant assure utility companies of longer, more effective protection of transformer parts. DBPC antioxidant inhibits the oil against oxidation, prolonging its useful life by preventing the formation of sludge deposits. Years of performance show that new transformer oils treated with DBPC antioxidant serve 14 times as long at a cost of only 1½¢ more per gallon. The result is superior protection of transformer insulation and reduced costs for maintenance and oil changes.

DBPC is not only low in cost, but it produces no detrimental side effects. It is easily and safely handled and requires only dissolving in the transformer oil. Its basic stability and long-range protection have served most of the oil refiners.

Koppers DBPC is also used by refiners in stabilizing other petroleum products such as gasoline, plastics, waxes, industrial fats, greases and industrial oils. For more information on using DBPC for your needs, write: Koppers Company, Inc., Tar Products Division, Pittsburgh 19, Pa.

KOPPERS

**KOPPERS**

**Koppers Company, Inc.**

*Offices in Principal Cities*

In Canada: Dominion Anilines and Chemicals Ltd., Toronto, Ont.

# *You save drilling dollars with*

# THE

**MUD PROBLEM:** Maintain a stable bay-water mud to drill through hydratable shales and formations containing high pressure gas and salt water.

### WELL DATA

*Location:* Timbalier Bay Field, Lafourche Parish, Louisiana
*Total Depth:* 15,376′

### MUD ADDITIVE PROGRAM

| | |
|---|---|
| 0′ to total depth | Q-BROXIN*, BAROID**, bay water, caustic soda, gypsum. |
| 12,876′ | Mud density increased to 12.3 ppg; Q-BROXIN treatment increased; Baroid Mud Centrifuge installed. |
| 13,276′ | FINE MICATEX**, and other lost-circulation materials added, maintained to total depth. |
| 14,302′ | Diesel oil added, maintained at 6% to 10% by volume to total depth. |
| 14,510′ | TRIMULSO** (0.5 lb/bbl) and E P MUD-LUBE†, (4.0 lb/bbl) added, maintained to total depth. |

### TYPICAL MUD PROPERTIES

| Depth, feet | 12,950 | 13,464 | 14,064 | 14,510 | 15,003 | 15,376 |
|---|---|---|---|---|---|---|
| Weight, ppg | 12.1 | 12.5 | 13.3 | 14.3 | 15.6 | 16.6 |
| Ave. sp gr, solids | 2.8 | 3.0 | 3.0 | 3.2 | 3.8 | 3.7 |
| Viscosity, sec. API | 55 | 48 | 54 | 66 | 58 | 65 |
| Stormer Gel, 10 min | 25 | 25 | 20 | 10 | 7 | 15 |
| Filtrate, ml, API | 5.5 | 4.9 | 3.9 | 1.6 | 1.8 | 1.2 |
| pH | 10.9 | 10.4 | 11.1 | 10.4 | 10.2 | 10.6 |
| Chloride, ppm (1000's) | 19 | 23 | 21 | 23 | 22 | 23 |
| Oil, % | 0 | 0 | 0 | 6 | 9 | 7 |

### CASING PROGRAM

| *Size Inches O.D.* | *Depth Set Feet* |
|---|---|
| 13⅜ | 6,464 |
| 9⅝ | 14,871 |

**DISCUSSION:** Major difficulties were anticipated below 14,000′ because of gas-bearing hydratable shales. Side wall coring, electric and induction logging and similar operations required an exceptional mud program. Salty bay water was used for making-up the liquid phase of the mud.

**SOLUTION:** Q-BROXIN mud was chosen as the basic mud additive from surface to total depth. The treated mud had a high degree of tolerance for solids, an inhibitive effect on hydratable shales and was not greatly affected by contaminants. BAROID was added to maintain weight, and FINE MICATEX was used to maintain good hole condition below 14,500′.

Total mud cost was about one-half the cost of previous wells of similar depths. 14,871′ of 9⅝″ casing was successfully set and cemented, the deepest of this size in this field. Side wall cores and good logs were obtained without difficulty.

**Registered Trademark, Baroid Division National Lead Company
†Trademark, Baroid Division National Lead Company
*Registered Trademark of Puget Sound Pulp and Timber Company

*a Baroid Mud Program*

# MUD PROBLEM

## ... and its solution

Total mud costs were cut in half and tight-hole problems were solved in this typical case history of a Baroid mud program. Through experienced engineering skill, a combination of Baroid mud additives were matched against a combination of down-hole conditions with successful results.

Gas pressure, salt contamination and tight-hole conditions were expected at depths below 14,000'. Side wall coring and electrical logging were desired. Using a bay-water — Q-BROXIN mud, frequent pilot testing, and special-purpose Baroid additives permitted successful drilling of the well and setting 9⅝" casing to a record depth in this field.

This demonstration is repeated daily in every major oil area. Baroid's improved concept of mud marketing is winning approval. By integrating material production, engineering research and distribution into a single chain, administered with utmost integrity, Baroid solves your problems and *saves your drilling dollars.*

RESISTS ANHYDRITE CONTAMINATION
OVERCOMES EFFECTS OF SALT WATER
KEEPS MUD STABLE AT HIGH TEMPERATURE
KEEPS MUD DEFLOCCULATED

**BAROID**

**BAROID DIVISION NATIONAL LEAD COMPANY**

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

BAROID

6008

# *Do you check these points When Buying* **STAINLESS STEEL** *Valves?*

- ☐ **How good are the castings?**
- ☐ **How precise is the machining?**
- ☐ **How rigid are the inspection and testing?**
- ☐ **How sound is the design?**

Just as important as a suitable stainless steel alloy are these four checks on valve quality. For long, dependable performance, a valve should rate *perfect* on every one.

There's a very good reason why you can be sure Jenkins Stainless Steel Valves will do that, unvaryingly:

For almost a century Jenkins has specialized in making valves. And making them to one standard of quality . . . the highest. Every operation and every worker is aimed at fulfilling that standard. The result is a product that can be backed by this 91-year-old assurance for valve users:

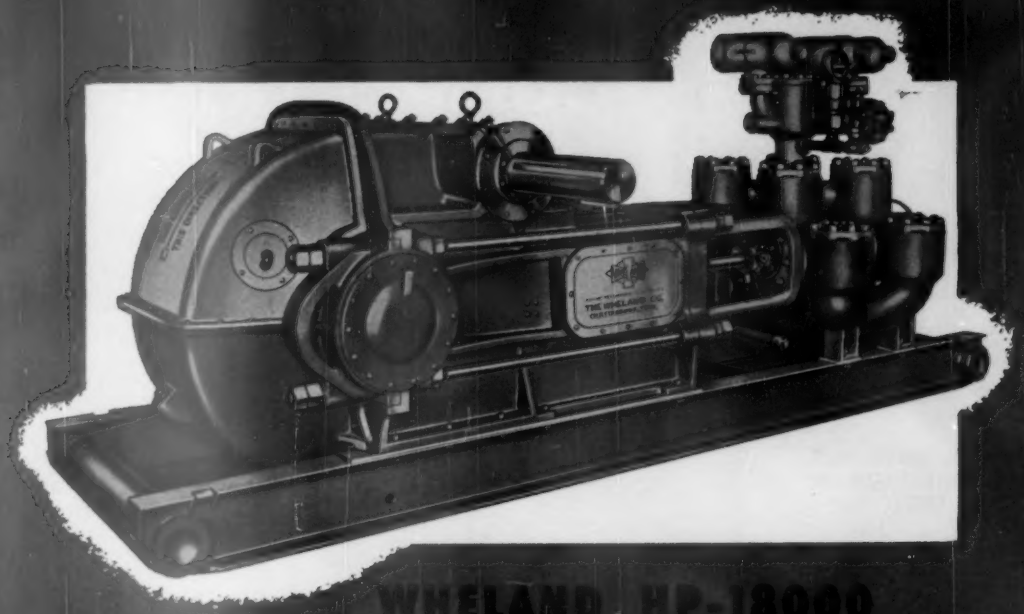
### *A Fair Offer*

***If you will put a Jenkins Valve, recommended for your particular service, on the worst place you can find . . . where you cannot keep other valves tight — and if it is not perfectly tight or it does not hold steam, oil, acids, water or other fluids longer than any other valve, you may return it and your money will be refunded.***

Order these reliable Jenkins Valves from your local Jenkins Distributor. Ask him or write us for Stainless Steel Catalog No. 59SS. Jenkins Bros., 100 Park Avenue, New York 17.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864 Jenkins Bros

*Sold Through Leading Distributors Everywhere*



**WHELAND HP-18000**
**DUPLEX POWER SLUSH PUMP**
*7¾"x18" 750 HP NOMINAL INPUT at 60 RPM*

# WHAT IS THE *OPTIMUM* PUMP FOR YOUR JOB?

You consider the pressure and volume needed, the weight and cost of moving the pump, the cost of power to drive it and your initial investment.

More and more men who know how to use big pumps are coming to the studied practical conclusion that a 600 to 750 hp input pump is **OPTIMUM** for their operations.

The Wheland HP-18000 pump gives you up to 826 gpm and 1,322 psi with 7¾" liners and up to 388 gpm and 2,700 psi with 5½" liners. It weighs only 36,377 lbs., is easily moved in one piece, is rated at 750 hp at 60 rpm, has six big features combined on no other pump and a top record for performance and dependability.

Detailed bulletin sent on request.

**It will pay you to see if this isn't the *OPTIMUM* pump for your job, too!**

# WHELAND

ROTARY DRILLING MACHINERY

**THE WHELAND COMPANY**
CHATTANOOGA, TENNESSEE, U.S.A.

**DRAW WORKS • SLUSH PUMPS • ROTARIES**
**CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS**

DOMESTIC DISTRIBUTORS: INDUSTRIAL SUPPLY COMPANY, INC.—Main Office: Wichita Falls, Texas • HOUSTON OIL FIELD MATERIAL COMPANY, INC.—Main Office: Houston, Texas.

EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.

# THE NEWS IS TUBINGLESS COMPLETIONS AND . .

The success of these money-saving completions depends on the efficiency of the tools you use. Make the most of your operation from completion to depletion with reliable Brown equipment for: Primary cementing, Squeeze cementing, Flowing production, Artificial lift, For running multiple tubing strings simultaneously.

**ALUMINUM SWAB WITH SHEAR PIN SAFETY JOINT**
A safe tool for swabbing operations. Safety Joint assures releasing from stuck swab and remainder of tool left in hole can be disposed of by acid.

**HOLLOW SUCKER ROD DRAIN TOOL**
This is the tool to eliminate pulling wet tubing strings; also, a built-in jar unseats a stuck pump.

**CAM-LOK TUBING ANCHOR**
This versatile tool can be run either as a tension-set or as a weight-set Tubing Anchor in pumping wells.

**PUMP DOWN PLUG**
To insure an uncontaminated primary cement job and eliminate the guesswork involved in displacement methods, this Pump Down Plug is the answer.

**LANDING COLLAR**
Serves as the receptacle to stop and lock the Pump Down Plug in place and then functions as a float collar to prevent back-flow of cement.

**CEMENTING FLOAT SHOE**
A dependable shoe with two back pressure valves to assure a pressure tight seal necessary to obtain a satisfactory primary cement job.

Brown tools for tubingless completions are available wherever you need them. Just call your nearest Brown representative for immediate information.

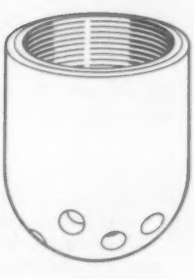
# ...BROWN CAN DO THE JOB

## Singles or multiples—all the way

**CAM-LOK PACKER**
To fulfill any production packer requirement, this packer can be used as either a tension-set or weight-set production packer.

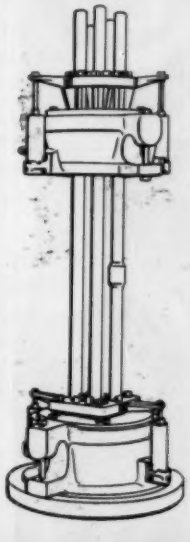
**ALUMINUM CAM-LOK PACKER**
For cement squeeze work,—here's the tool made of aluminum for easy removal in cases of extreme emergency.

**CENTRALIZER**
To assure centralization of one or more production strings, these rugged centralizers do the job.



**GUIDE SHOE**
Manufactured from aluminum stock—simple in design and easy to handle.

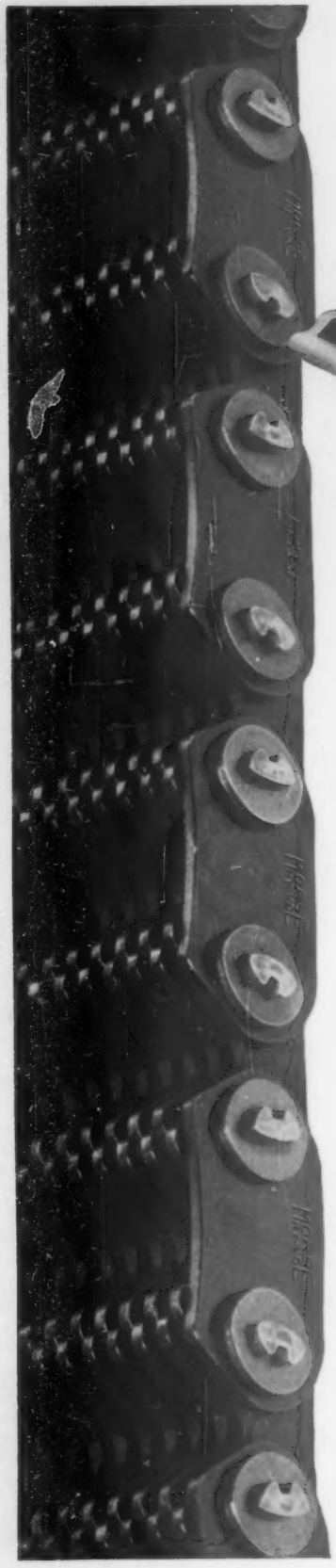
**CENTER LATCH SLIP TYPE ELEVATORS**
20 Ton Elevators reduced to weigh 25 pounds — extremely easy to handle and operate — for use in concentric workovers for 1" — 1¼" — 1½" regular and thin-wall tubing.

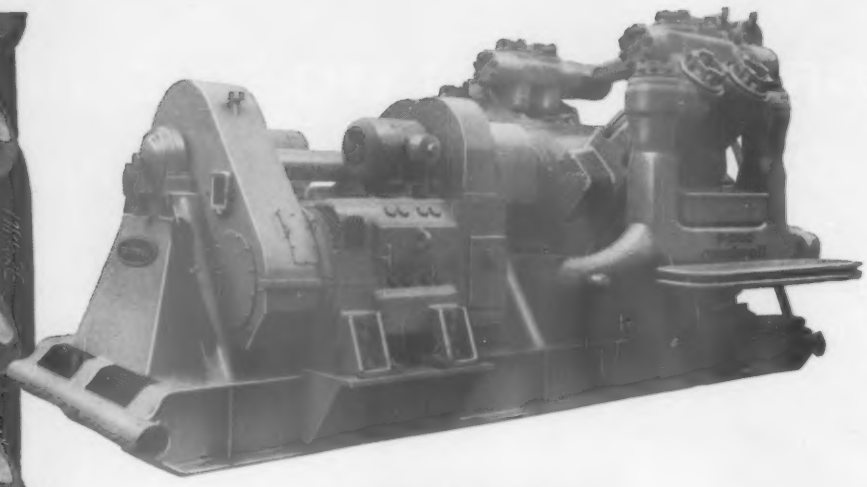


**POWER-ACTUATED ELEVATORS AND SLIPS**
Available for two, three, or more tubing strings, these Power-Actuated tools assure getting to bottom in record time, eliminate depth limitations imposed on tubing strings imposed by parasite ("piggy-back") method, and permit reciprocation during cementing operation.

**BROWN**
**OIL TOOLS, INC.**

8490 KATY ROAD, P. O. BOX 19236, HOUSTON 24, TEXAS





# MORSE HY-VO® DRIVES

## Compound Power For World's Highest Capacity Slush Pump!

**Two 750 hp electric motors at 1200 rpm are compounded through Morse HY-VO Drives . . . 27-tooth to 49-tooth sprockets using 1½″ x 8″ HY-VO Chains . . . each of 152 links or 19 ft in length**

Here is an outstanding example of how Morse exclusive Hy-Vo* Drives break through the speed barrier with performance unequalled by any roller chain . . . another contribution to modern oilfield product design. Through Hy-Vo capacity for both speed and power, in compact size, these drives permit Cardwell to build not only the world's highest capacity slush pump, but the world's most compact, lightest weight, unit per horsepower.

For more than nine consecutive years Morse Hy-Vo Drives have demonstrated that any pitch of any Hy-Vo Chain will run faster than the equivalent pitch of roller chain and carry far more horsepower. For further information write Morse Chain Company, Dept. 22-90, Ithaca, N.Y. Warehouses in Casper, Wyoming; Houston and Odessa, Texas; Farmington and Hobbs, N.M.; Los Angeles, Calif. Export Sales: Borg-Warner International, Chicago 3, Ill. In Canada: Morse Chain of Canada, Ltd., Simcoe, Ont.

*"HY-VO", the coined name for this exclusive Morse design (from High Velocity and Involute, the sprocket tooth design) which differs widely from conventional chain design. U. S. Patent No. 2,725,755.

MORSE BW

A BORG-WARNER INDUSTRY

**ONLY MORSE OFFERS ALL FOUR:**

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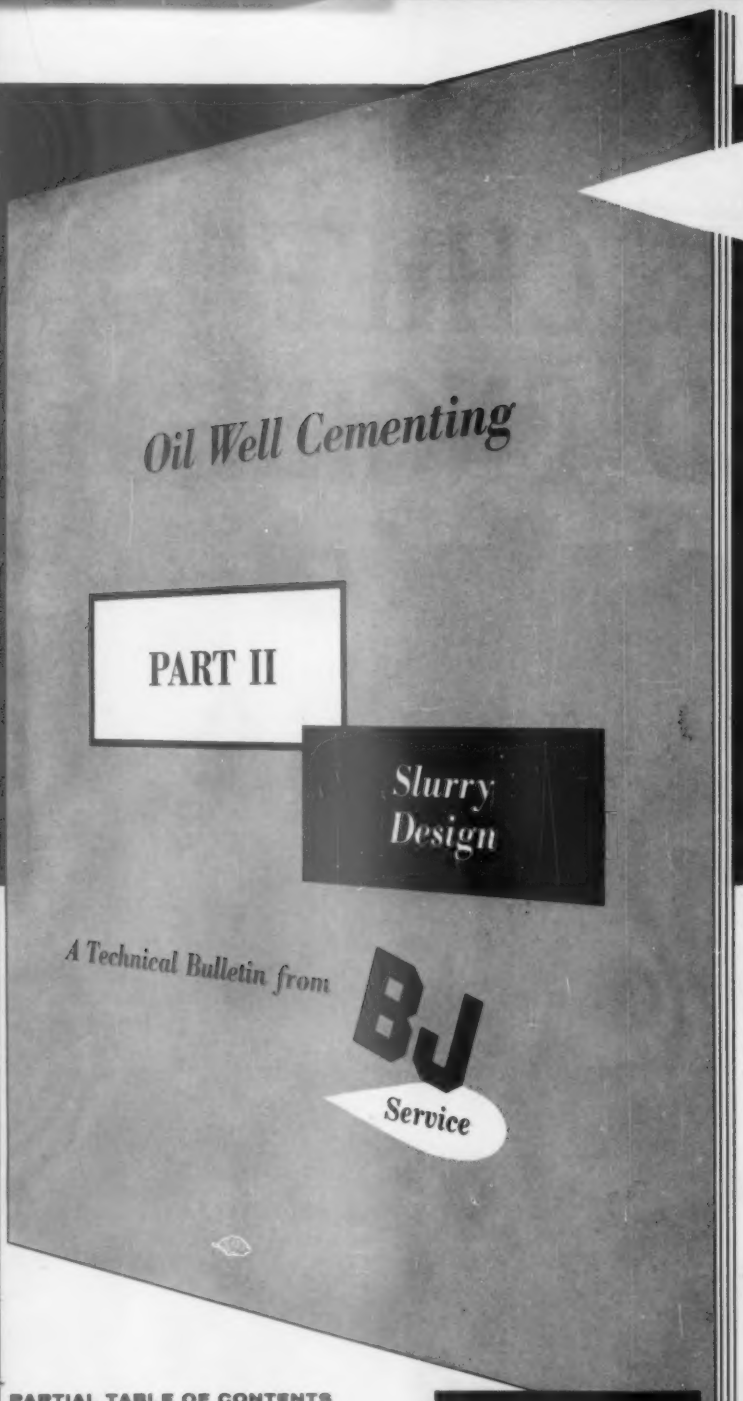
2. EBERHARDT-DENVER SPEED REDUCERS
3. FLEXIBLE COUPLINGS
4. WIDE CAPACITY CLUTCHES




# NOW...

## Another first!

## BJ Service offers you the answers to your Cement Slurry Problems!*

Here is a new BJ Service Technical Bulletin on cementing—*the first study of its kind ever published!* Organized to eliminate hours of research and involved calculations, it provides a rapid, efficient comparison of most cement slurries on the basis of yield, weight, volume, thickening time, strength, cost and other important factors.

Assuming a knowledge of any particular well, this Bulletin shows engineering or field personnel how to design a slurry for that well... contains a wealth of other valuable, concentrated reference material that cannot be duplicated from any other source.

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***WRITE TODAY!***

**PARTIAL TABLE OF CONTENTS**

- Correct use of admixes
- The Design of slurries
- Control of slurry properties
- Survey of portland cements

*"Slurry Design," is a companion bulletin to "Principles and Practices of Oil Well Cementing," recently published by BJ Service.

**BJ SERVICE, INC.**
A Borg-Warner Subsidiary
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Please rush me my copy of the new BJ Service Technical Bulletin, "Slurry Design."

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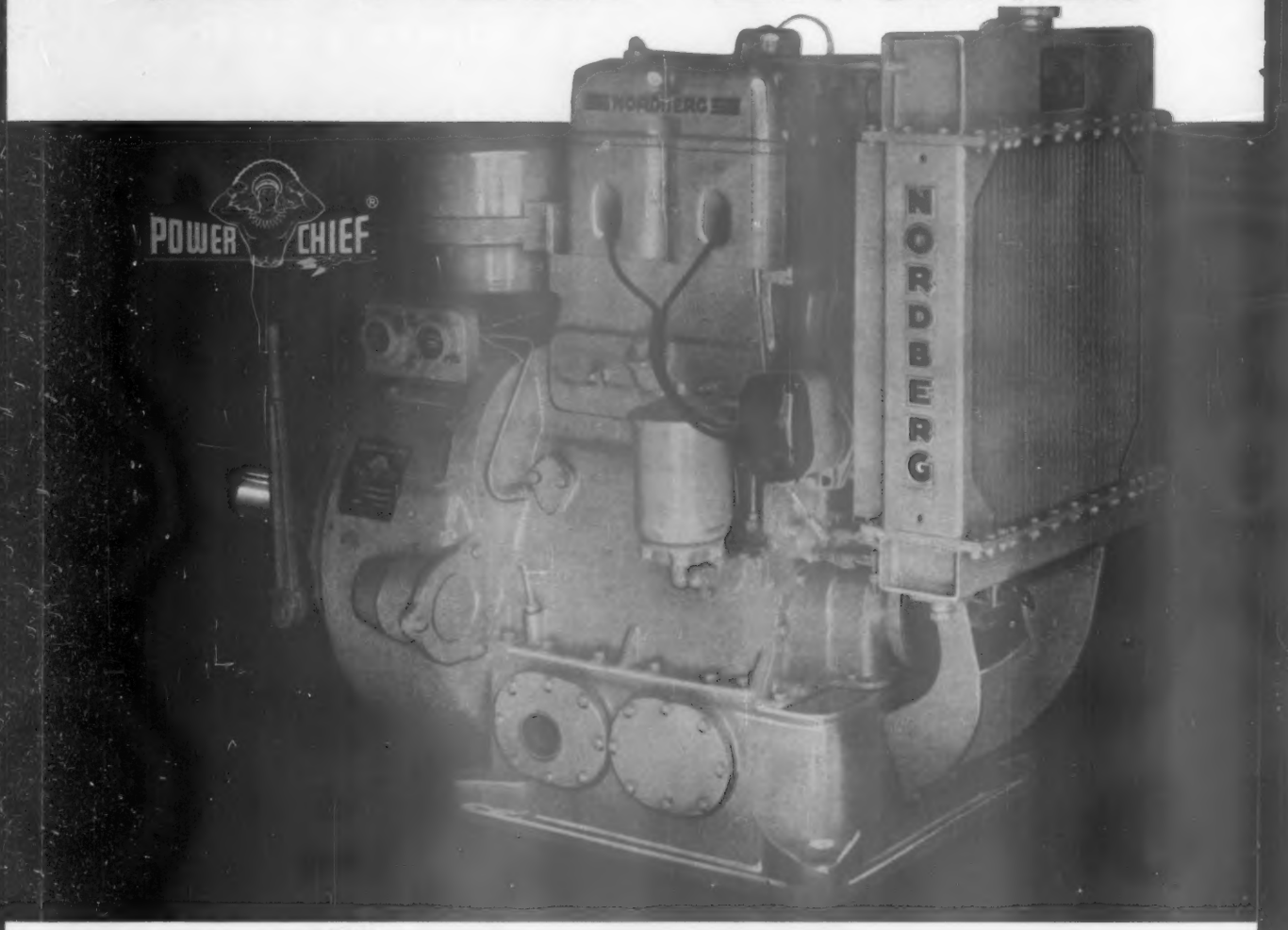
NOTE: If you would also like a copy of Part I, "Principles and Practices of Oil Well Cementing," please check here. ☐

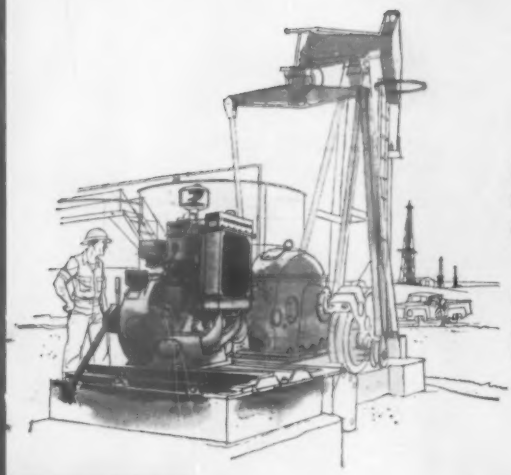
PERFORMANCE-PROVED

# POWER CHIEF® OIL FIELD ENGINES




Throughout the oil fields, Power Chief Diesel and Gas Engines are consistently achieving records for reliability and low maintenance costs. Built in 1, 2 and 3-cylinder sizes, all having 4½" bore and 5½" stroke, these heavy duty, medium speed units develop up to 54 hp max. Here are some of their important features:

Smooth, steady operation—heavy flywheel eliminates surging during pumping stroke . . . More safety features—including enclosed flywheel, enclosed clutch, enclosed fan, magneto impulse coupling eliminates starting kickback . . . Full pressure lubrication throughout engine . . . Lube oil heat exchanger eliminates sludging of oil in crankcase . . . Can be easily converted from gas to diesel operation . . . No extras to buy, engine comes complete with clutch and safety shutdown controls . . . Easy to service.



## for production pumping and water flooding...

It will pay you to consider that actual Power Chief case histories show over 43,000 hours of continuous pumping operation—*with original rings, pistons, liners, bearings and crankshaft still in place!*

Here, then, is positive proof that Power Chief oil field engines, in sizes to 54 hp. really deliver the kind of rugged, day-in, day-out power you need for dependable production pumping and water flooding service at the very lowest maintenance cost.

## for rig lighting...

Power Chief Diesel Electric Generator Sets are turning night into day for 24-hour drilling operations . . . as more and more drillers discover that these sturdy units can stand the gaff of continuous service, night after night, without constant attention and maintenance.

Built in 1, 2 and 3-cylinder sizes, Power Chief Diesels develop from 10 to 45 hp, 5 to 30 kw, in all standard AC and DC voltages . . . and all available with special vibration-proof mounting for rig installation.

## for micro-wave communications...

Nordberg Power Chief Diesel generating units are being used to provide low cost, dependable power for both stand-by and main power source in micro-wave pipe line radio communication systems. And remember . . . these compact, rugged units are backed by the same reputation for dependability as the larger Nordberg engines used across the nation for low cost pipe line pumping service.

**NORDBERG MANUFACTURING COMPANY**
**Milwaukee 1, Wisconsin**

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PC1-60

**An everyday load.** This B Model Mack is ready to take off cross country with typical cargo of oil well equipment.

## Profit-making oil rig moves

# start with PROFIT-MAKING TRUCKS

"This business would be a cinch if every job was as easy as picking my trucks," says M. T. Buckaloo who heads up Buckaloo Trucking Co., Kenedy, Texas, veterans of hundreds of oil rig moves. "Any job goes easier with good equipment, and ours is no exception. I figure you can't buy better than the best, so I stick with Mack trucks."

Overland trucking, loaded with drilling rigs, draw works and other heavy oil-field equipment, is all in the day's work with Mack trucks. You know your trucks have to be able to take it—and you can be sure they will if they're Macks.

The ability to get through—no matter what the weather or terrain—has made Mack the outstanding choice for tough oil-field service. Extra strong frames and chassis take jolt and shock in stride, and the Mack exclusive Balanced Bogie with Power Divider provides torque to the wheels with the best traction—gives Mack six-wheelers the ability to tackle the worst kind of going without bogging down.

Your Mack branch or distributor will be glad to show you why Mack trucks can save you plenty in terms of downtime, delays and headaches. Call him today. Mack Trucks, Inc., Plainfield, New Jersey. Mack Trucks of Canada, Ltd., Toronto, Ont.

**MACK**
FIRST NAME FOR
**TRUCKS**

7363

**Big load is winched aboard.** A Mack B-61 Model pulls derrick foundation onto low-boy trailer for move to next drill site.

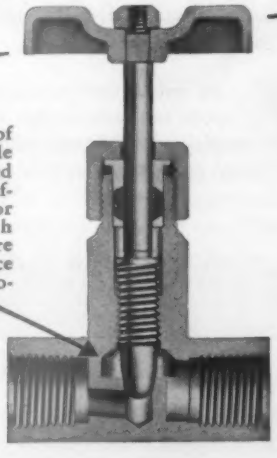
**Oil-field roads don't amount to much.** Cross-country travel is all in a day's work for the Macks and men of Buckaloo Trucking.

**MAXIMUM WORKING PRESSURE**
**10,000 PSI**
*for water, oil or gas*

- Body and stem guide extra heavy bar stock fused into one piece.
- Valve stem 416 stainless steel.
- Packing special one-piece "Marpak" moulded ring.
- Bodies marked in accordance with MSS regulations.

**ONE PIECE**

The stem guides of conventional needle valves are screwed into bodies—this often causes leakage or blow-outs. Marsh Needle Valves are fused into one-piece by exclusive "Conoweld" process.



# The Ultimate in Needle Valves

Here is one of the crowning achievements of Marsh research, design, and manufacturing skill. It is the first needle throttling and shutoff valve to combine *all* of the qualities called for today in this highly critical and ever broadening field.

It is a valve that has strength and safety to spare . . . rated for pressures up to 10,000 psi—equally efficient in the lower ranges. A product of Marsh instrument-making and valve manufacturing experience, it combines instrument-like precision with the ruggedness that distinguishes all Marsh valve specialties.

The illustrations tell the story of new thinking; new standards. Body and stem-guide are machined from extra-heavy carbon steel bar stock. Still greater strength and rigidity are achieved by fusing the stem-guide into the body. The complete fusion of guide and body is accomplished by the exclusive Marsh "Conoweld" process.

There are two big advantages to this one-piece construction: (1) It eliminates the danger of unscrewing the valve from the body when opening—a frequent cause of leakage, even dangerous blow-outs (2) It permits perfect line-up of threads and seat. As a result, Marsh valves are easier to operate even at high pressures.

The precision-machined stem is 416 stainless steel. Stem threads are fine pitch for extra strength and fine, controlled regulation. Notable advancements are special "Marpak" one-piece, non-binding longer-lasting packing; deep thread chambers, keeping inlet and outlet piping away from ports and contributing excellent flow characteristics. Entire packing nut and packing gland are electro-zinc plated, preventing corrosion and giving the valve a handsome, plated exterior. The rugged malleable handle is finished in heavy baked enamel.

The new needle valve line includes globe and angle patterns with double female connections in sizes ⅛", ¼", ⅜", ½", ¾" and 1". Also globe and angle valves with male inlet and female outlet in sizes ¼" and ½". *Complete stock carried at our Skokie, Illinois factory and also at our branch plant in Houston, Texas.*

**Write today for catalog giving complete details.**

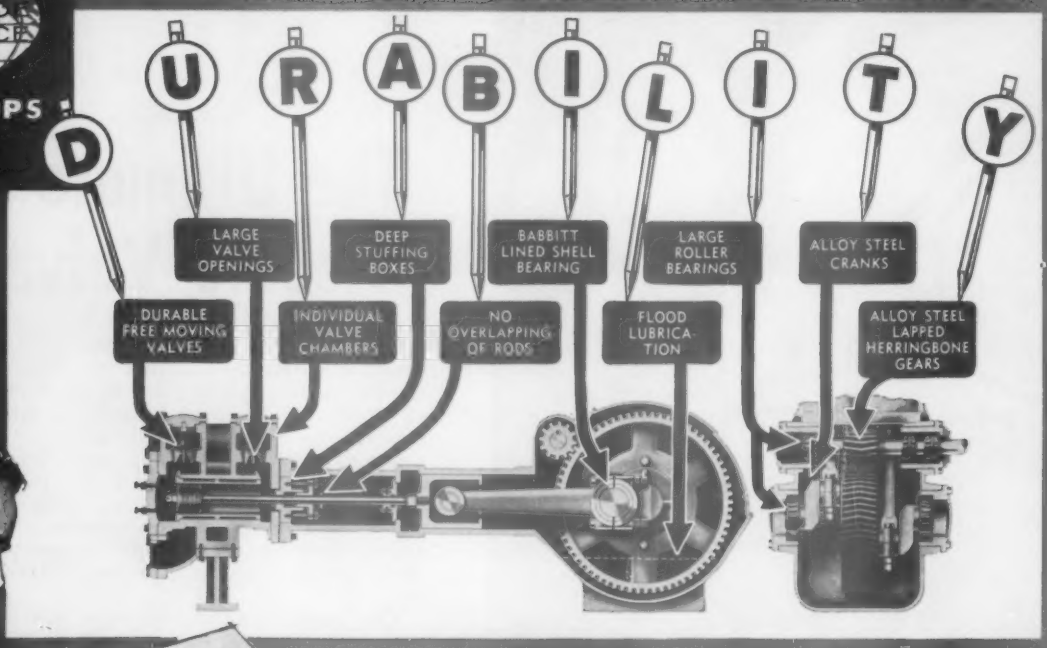
**MARSH INSTRUMENT COMPANY, Dept. L. Skokie, Ill.**

*Division of Colorado Oil and Gas Corporation* • Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta • Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Tex.

**MARSH**

"THE STANDARD OF ACCURACY"

GASO PUMPS :


D U R A B I L I T Y
LARGE VALVE OPENINGS
DEEP STUFFING BOXES
BABBITT LINED SHELL BEARING
LARGE ROLLER BEARINGS
ALLOY STEEL CRANKS
DURABLE FREE MOVING VALVES
INDIVIDUAL VALVE CHAMBERS
NO OVERLAPPING OF RODS
FLOOD LUBRICATION
ALLOY STEEL LAPPED HERRINGBONE GEARS

# NOTHING "ACCIDENTAL" ABOUT GASO PERFORMANCE

## It's DESIGN that Explains Why Gaso Pumps Perform Better, Last Longer

There's no mystery about the extra years of trouble-free service you get from Gaso Pumps. It's all a matter of DESIGN.

Every detail of Gaso design is the development of 45 years' concentration on oil-industry pumping needs. Every part from main frame to gaskets reflects Gaso's continuous search for metallurgical and engineering advances which contribute to the goal of *maximum* performance and *minimum* upkeep, achieved with *fewer* parts made *extra-strong*.

In other words, it's the absence of weak spots in both design and components that explains the *bonus* of performance you get from Gaso Pumps.

**GASO PUMPS**
*for every oil industry need*

SEND FOR OUR 1960-61 CATALOG

GASO PUMP & BURNER MFG. CO.
FIRST and LANSING STS., TULSA, OKLAHOMA
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NEW YORK, N. Y.

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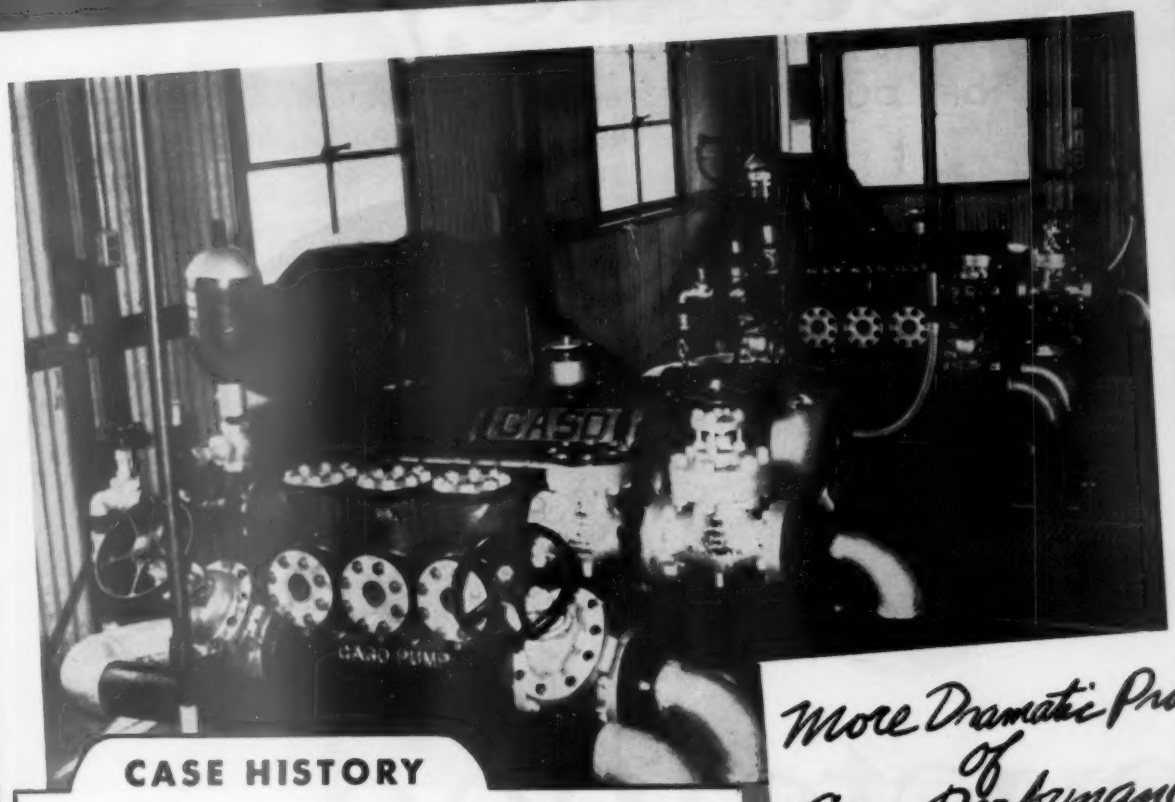
# BARRELS PUMPED! 1,504,320
# TOTAL MAINTENANCE COST: $73.89




## CASE HISTORY

**PUMP:** Gaso Fig. 3466 Horizontal Triple Plunger Pump placed in salt water service June 1, 1957, operating at 225 RPM against 900 PSI.

**PERFORMANCE:** During the period of this report, the pump discharged a total of 1,504,320 barrels of salt water.

**TOTAL SERVICE REQUIRED:** Repacking of plungers after 7½, 15 and 27½ months' service.

**TOTAL MAINTENANCE COST:** $73.89—less than 5¢ per 1000 barrels pumped.

In water flooding as in pipe line service, Gaso performance speaks for itself, proves over and over that Gasos are the logical choice of operators who buy on the basis of maximum performance at minimum cost. May we send you our 1960-61 catalog?

*More Dramatic Proof of Gaso Performance in Water Flooding Service!*

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*for every oil industry need*

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# accuracy

**ASHCROFT DURAGAUGES** measure pressure with precise accuracy no matter how severe the conditions of service

*Ashcroft Duragauges are available in pressure ranges from 15 psi (or vacuum) minimum to 100,000 psi. Dial sizes: 4½" through 12".*

# sustained

The Bourdon tube in Ashcroft Duragauges is manufactured to precision standards of flexibility and mono-linked to the rotary movement. When pressure flexes the tube, the gauge pointer is always positively positioned, because it is mounted on the geared center shaft of the movement. Sustained high accuracy and long life are assured.

Choose your Ashcroft Duragauges made of components best suited to your needs. Eight Bourdon tube materials are available. Movement of stainless steel with nylon bearings and pinion gear for longest wear. Case materials: special aluminum alloy or tough phenol plastic.

The unique "Maxisafe®" Duragauge provides absolute protection to the viewer, plus easy and quick access to the mechanism. Your industrial supply distributor will help you select the best combination of components for your Ashcroft Gauge requirements. Phone him today or write for Catalog 300B.

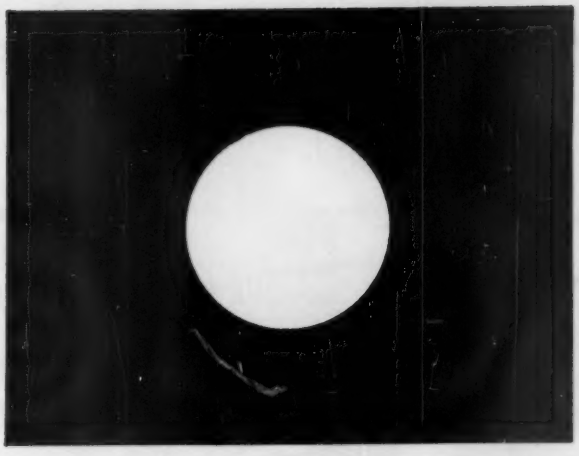
**ASHCROFT PRESSURE GAUGES**

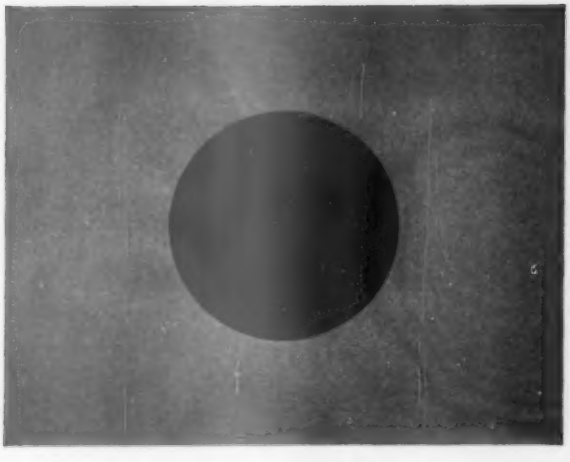
*A product of*

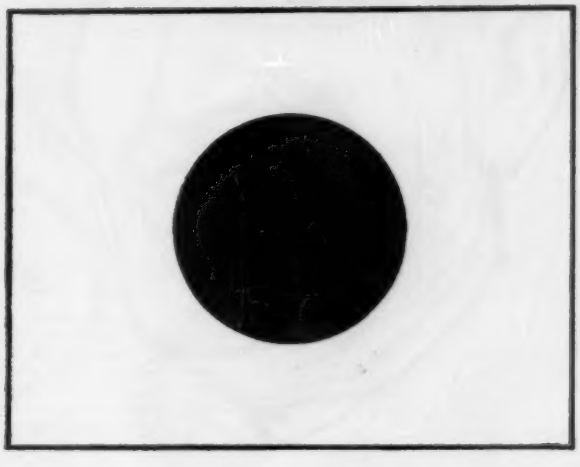
**MANNING, MAXWELL & MOORE, INC.**

*Gauge and Instrument Division • Stratford, Connecticut*
*In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

*Which is the smallest circle?*







# Can you tell the real thing when you see it?

Appearances are deceiving . . . sometimes. But not always.

Have you seen CARBOSE® MX at work? This special grade of CMC was developed specifically for drilling muds. It improves sealing properties, reduces water loss. It's good for mud. It's made for mud. Try it in yours. We think you'll see the difference without difficulty.

Wyandotte offers a number of drilling mud additives, as well as materials for gas dehumidification, demulsifying, emulsifying, secondary recovery, water treatment, cementing, sweetening, and many other petroleum, refinery, and petrochemical applications. Get full details from your distributor, or write: *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Baton Rouge, Louisiana. Offices in principal cities.*

**ANSWER:** If you guessed that the circles are all the same size, your perception is normal . . . but your guess is wrong. The white circle is smallest. Measure it!

* * * * *

**WYANDOTTE CHEMICALS**

**MICHIGAN ALKALI DIVISION**

*PACING PROGRESS WITH CREATIVE CHEMISTRY®*

ANOTHER HOMCO DIRECTIONAL DRILLING SUCCESS REPORT

# Two Directional Drilling problems where Homco equipment saved hours of rig time

Gulf Coast independent operator says:

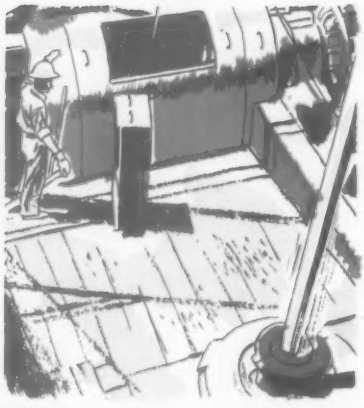
**"Homco's Mechanical Orienting Tool saved me eight hours and fifteen minutes wire line time on two settings below 14,000 feet."**

Terrebonne Parish, Louisiana

1. First whipstock was set at 14,363 feet with conventional BHO method and checked. Time required to orient tool was four and one-half hours. Second whipstock was set at 14,821 feet using a 6" O.D. Homco Mechanical Orienting Tool. Time required was thirty minutes. (Results were perfect.)

2. Third whipstock was set at 15,080 feet with the same Homco Mechanical Orienting Tool. Time required fifteen minutes. (Perfect results.)

3. The Homco Mechanical Orienting Tool saved more than four hours rig time each time it was used. It also eliminated the hazard of stuck pipe as the string can be actuated and circulation maintained. Abnormally high temperatures and extremely heavy muds have no effect on this tool.



## Homco Mechanical Orienting Tool*

The HOMCO Mechanical Orienting Tool presents a new concept for orienting whipstocks and deflecting tools without the use of subsurface surveying instruments, which previqusly required two or more trips with a wire line to correctly orient the deflecting tool. The drill pipe is raised, rotated, and lowered until a ball falls into a slot which permits the tool to close and indicates that the deflecting tool is correctly oriented.

**ADVANTAGES:** Eliminates numerous trips into the hole with subsurface surveying instruments. Reduces orienting time to approximately twenty (20) minutes. Torque in drill string does not affect setting. Not affected by high temperature. Write for Technical Bulletin #51-1-1.

*Patent—U.S. Letters Patent No. 2,686,660

**NEED THE ANSWER**

**TO A DIRECTIONAL DRILLING PROBLEM?**

**HOMCO HAS IT!**

HOMCO

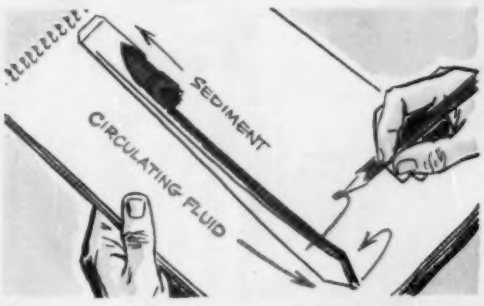
DIRECTIONAL DRILLING

California tool pusher says:

**"Homco's Circulating and Releasing Whipstock is the only tool that circulates to the bottom of the hole and assures a firm setting for the whipstock."**

"We've learned now that when we have to set a deflecting tool in the hardrock country, it saves time and money to have the Homco Circulating and Releasing Whipstock on hand. It has saved us rig time in West Texas, California, the Rockies, and Canada."

1. The HOMCO C&R Whipstock is installed on the drilling string and is lowered into the hole. There is no danger of shearing the pins. Should a bridge or fill be encountered, the whipstock is raised, circulation started, and the tool is rotated through the obstruction.




2. On reaching the bottom of the hole, circulation is commenced to wash any sediment or cuttings free which may impede the setting of the whipstock. Circulation and rotation are continued until the whipstock can be set firmly on the bottom of the hole. The whipstock can now be oriented in the correct direction by means of the HOMCO Mechanical Orienting Tool, or by other sub-surface orienting means.

3. After orientation, a ball is dropped into the drill pipe and pumped down to land in the ball seat on the upper end of the piston in the setting tool. The pumps apply pressure to the piston assembly until the pins between the upper shell and piston are sheared. The piston is forced downward permitting the shear balls to be forced from a position between the whipstock collar and lower shell into the setting tool. This diverts the circulation from the whipstock to the drill bit and disengages the setting tool from the clutch arrangement in the whipstock collar by lowering the drill string slightly. When disengagement is accomplished, rotation is commenced and a rathole is drilled in the conventional manner.

## Homco Circulating and Releasing Whipstock*

In most directional drilling operations, a problem is the removal of sediment and cuttings that settle to the bottom of the hole after circulation ceases. This fill prevents the whipstock from reaching the bottom of the hole.

The HOMCO Circulating and Releasing Whipstock permits sediment to be circulated out of the hole before setting, eliminating mis-runs with whipstocks. The circulating fluid is channeled through the whipstock to the lowest point of the tool. While circulating, the HOMCO C&R Whipstock can be rotated without danger of shearing pins, assuring a firm seat.

**ADVANTAGES:** Eliminates danger of shearing pins while going into the hole. Whipstock can be rotated without danger of shearing pins. Circulation can be obtained at bottom of the tool where it is needed. Whipstock can be rotated and circulation maintained on bottom before setting, to assure a firm seat. Write for Technical Bulletin #94-7-1.

*Patent—U.S. Letters Patent No. 2,823,012

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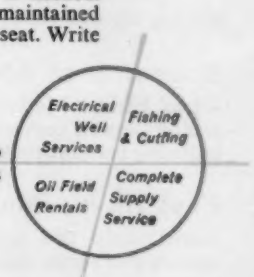

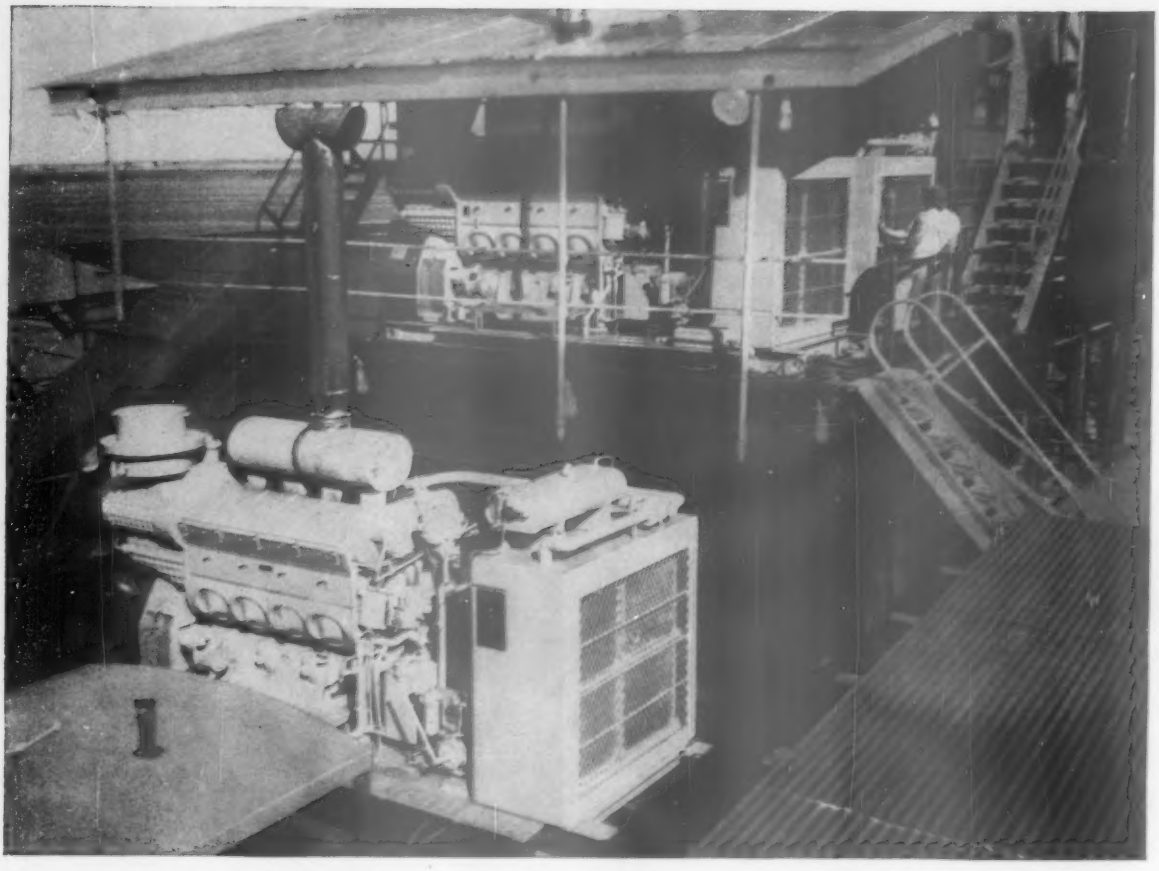

# Electro-Motive engines drive Penrod's deep-drilling rig

## First application of two 1000-hp Diesels on mechanical rig

Penrod Drilling Company's Rig 15 is one of the biggest mechanical rigs in deep-drilling capacity —25,000 feet. Yet, it accomplishes this with just *two* normally aspirated Electro-Motive Diesel engines on the draw works.

One of the rig's two mud pumps is V-belt driven off the rear of the engine compound and the second is driven by a separate Electro-Motive skid-mounted with the pump.

Penrod's choice of Electro-Motive Power for the big rig was based on three factors:

### Economy of operation

—two Electro-Motive Diesels cost less to run than a multi-engine compound of similar horsepower, plus reducing maintenance with fewer engines to service.

### Fast rig-up and take down

—with only two engines, mobility, efficiency and economy of transportation are provided. At its present location, Rig 15 was set up in two days and drilling began the morning of the *third* day.

### Dependability

—although this is the first application of Electro-Motive Power coupled directly to the draw works of a rig, these engines have powered generators on electric rigs for many years. Their performance, reliability and low maintenance have been instrumental in setting a number of drilling records.

This is just another example of Electro-Motive Power; Power that is designed, built and backed by *one* manufacturer. See your Electro-Motive representative—ask about this versatile power for economical drilling and pumping operations.

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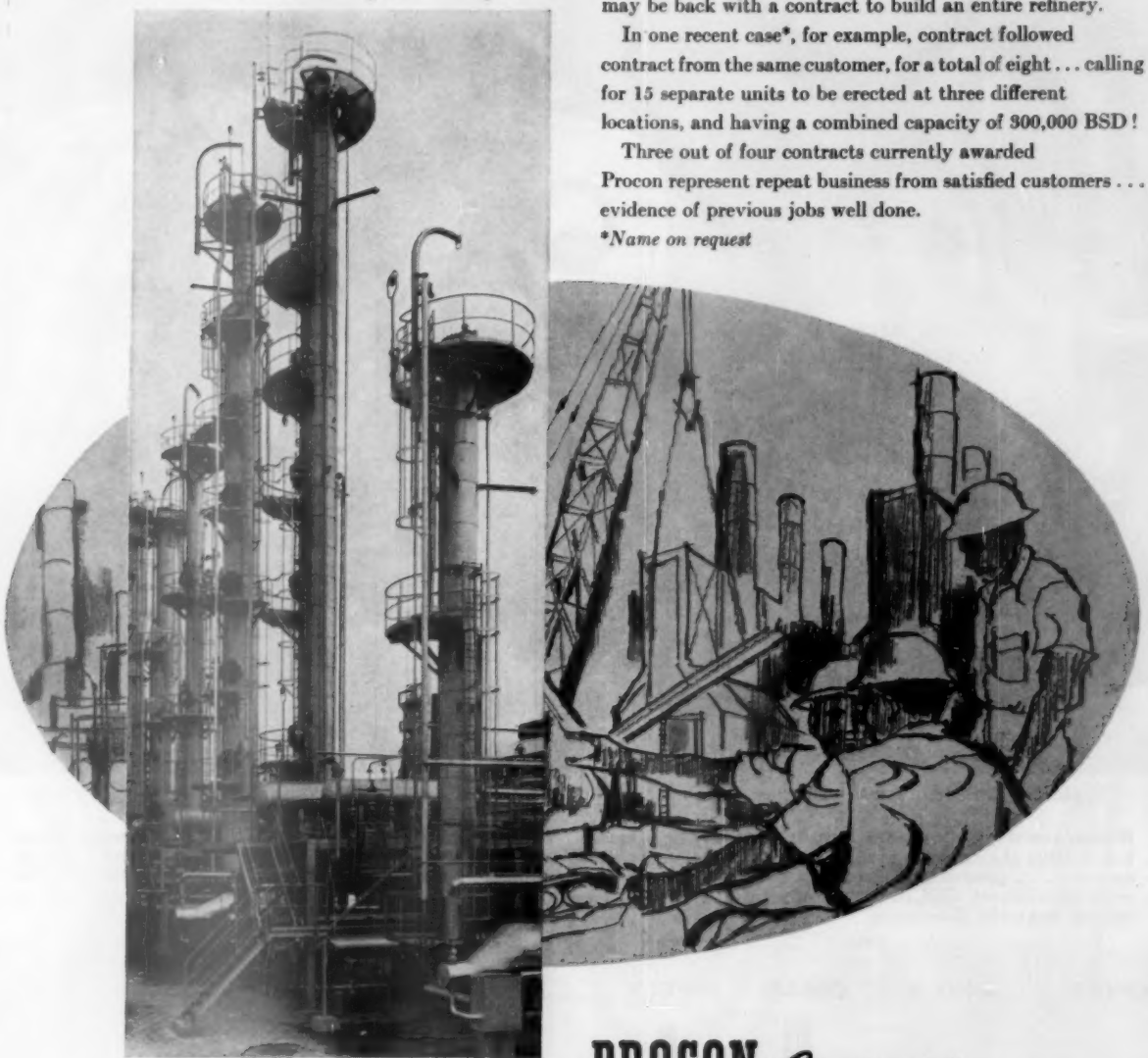

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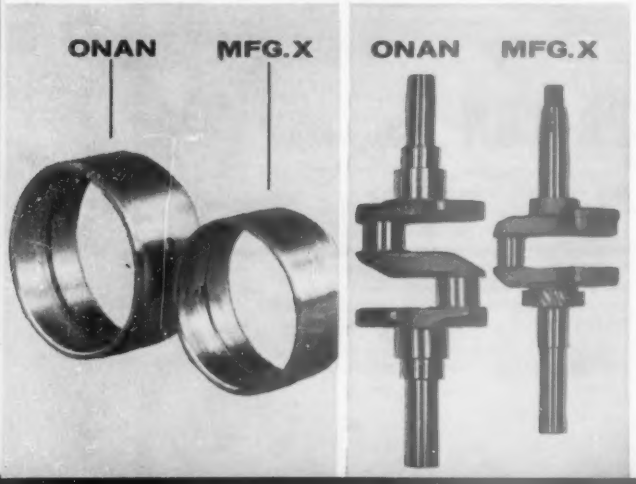

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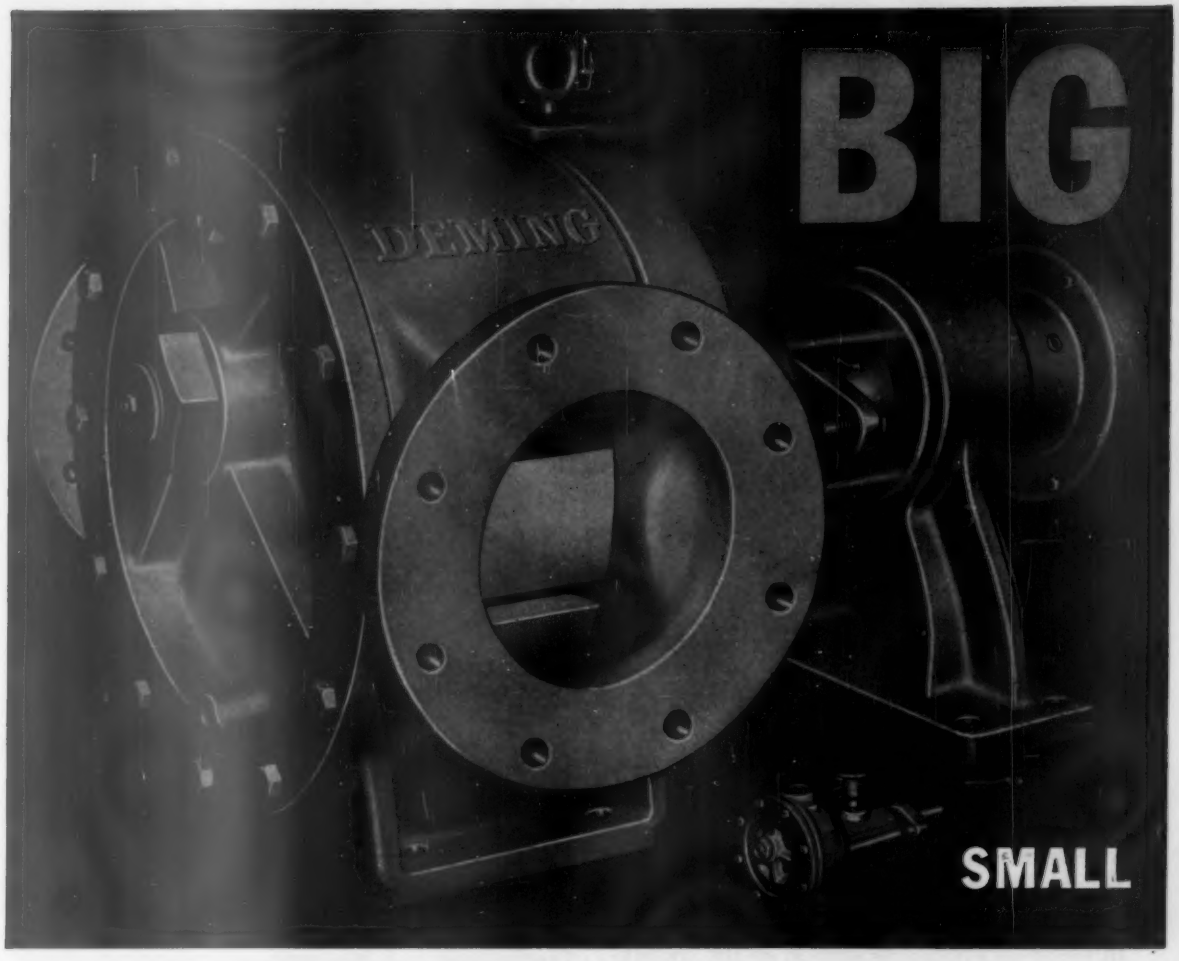


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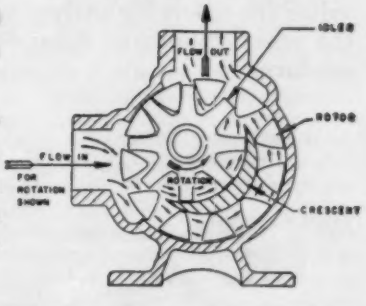


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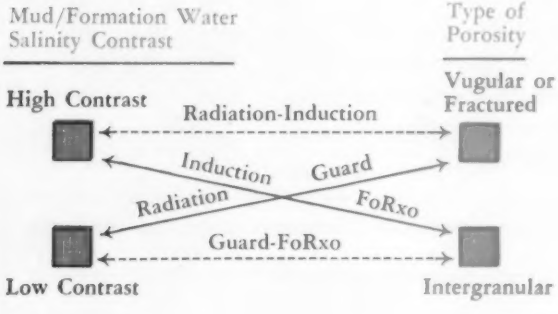


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# They Say—

## It wasn't their doing

Dear Sir:

May I correct the article in your September 5 issue ("It's All-Out War on the Temporary Tax," p. 95) in which you referred to the Gasoline Tax Education Committee. Please be informed that:

1. We are **not,** as you state, "a special group of the American Petroleum Institute." The committee is a separate organization.

2. The committee is not, as you state, "directing" a petition signing campaign. We have no connection with any such campaign.

3. None of the three pieces of material used in your article was developed by or issued by our committee.

Our activities are limited solely to the use of paid advertising.

Stefan F. Blaschke
Executive Secretary
Gasoline Tax Education Committee
New York

## First underwater completion

Dear Sir:

In your article covering the oil well completed underwater offshore Peru (OGJ, Aug. 29, p. 63) . . . this well is represented by you as being the first commercial oil well successfully completed offshore under water.

Last year this company drilled the Place Colchester 1 well offshore in Lake Erie and completed same as a successful oil well on the lake bottom. As it was too late in the season to tie in this well to the tank battery onshore, this work was carried out in June of this year. Therefore, we have what we think is the first commercial oil well completed offshore at the lake bottom.

Although the lake is rather shallow in this area, we completed the well at the bottom of the lake rather than on a platform owing to icing conditions during the winter months and the pressure of ice flows in the spring.

The well is currently free flowing with an average production in excess of 200 bbl. daily, and has run as high as 600 bbl. daily. It is a 42° gravity crude.

In anticipation of eventual pumping requirements, a gathering line 3 and 2-in. pipe has been laid to the well, a distance from the tank battery of 3,000 ft. We expect to install a bottom hole

hydraulic pump and then the 2-in. line will provide the power fuel and produce through the 3-in. line.

This system will also provide "solvents" to eliminate wax off.

Since the completion of this work, we have also finished the Place Colchester 4, a thousand feet further out in Lake Erie, and the same completion technique has been applied.

Clifford R. J. Smith
President
Place Gas & Oil Co., Ltd.
Toronto

**Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.**

# CALENDAR OF EVENTS

**SEPTEMBER**

26-29 American Welding Society, fall meeting, Penn-Sheraton Hotel, Pittsburgh.

26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

27-29 Mid-West Gas Association, annual school and conference, Memorial Union, Iowa State College, Ames.

28-30 University of Oklahoma and National Association of Corrosion Engineers, Central Oklahoma section, seventh annual corrosion control short course, North Campus, University of Oklahoma, Norman.

29-30 Mid-Continent Oil and Gas Association, Mississippi - Alabama division meeting, Grand Hotel, Point Clear, Ala.

29-Oct. 1 West Texas Geological Society, field trip, Delaware basin of West Texas and Southeast New Mexico.

**OCTOBER**

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.

4-5 University of Kansas, gas-measurement institute, National Guard Armory, Liberal, Kans.

5 Society of Plastics Engineers, Inc., regional technical conference, Mark Hopkins Hotel, San Francisco.

5-7 Four Corner Geological Society, third field conference, geology of the central Paradox basin, registration Oct. 4, Moab, Utah.

6-7 National Association of Corrosion Engineers, annual western region conference, Sheraton-Palace Hotel, San Francisco.

6-8 National Association of Corrosion Engineers, southeast region conference, Dinkler-Plaza Hotel, Atlanta, Ga.

6-8 National Academy of Sciences, National Research Council, ninth national clay conference, Purdue University, Lafayette, Ind.

10-12 American Gas Association, annual convention, Atlantic City.

11-14 National Association of Corrosion Engineers, northeast region conference, Prichard Hotel, Huntington, W. Va.

12-14 Southwestern Federation of Geological Societies, annual meeting, Wooten Hotel, Abilene, Tex.

13-14 California Natural Gasoline Association, annual fall meeting, Hotel Miramar, Santa Monica, Calif.

13-15 Southwestern Legal Foundation, American Association of Petroleum Landmen, second national institute for petroleum landmen, Dallas.

13-16 Taft, Calif., Oildorado, fifieth anniversary celebration.

14-15 University of Texas, E. P. Schoch lecture series on rate processes, Batts Hall Auditorium, Austin.

14-16 New Mexico Geological Society, annual field conference, Chama basin of northern New Mexico, registration, Taos, Oct. 13.

17-19 American Society of Mechanical Engineers, American Society of Lubrication Engineers, lubrication conference, Statler Hilton Hotel, Boston.

17-19 University of Minnesota, Pennsylvania State University, Colorado School of Mines, biannual symposium on drilling and blasting, Golden, Colo.

17-Nov. 5 University of Oklahoma, School of Petroleum Engineering, short course in advanced drilling practices for engineers, University of Oklahoma, Norman.

19-20 National Association of Corrosion Engineers, north central region conference, Schroeder Hotel, Milwaukee.

19-21 Gulf Coast Association of Geological Societies, convention, Biloxi, Miss.

19-21 Rocky Mountain Oil and Gas Association, annual convention, Brown Palace Hotel, Denver.

20-21 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

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20-23 Permian Basin Oil Show, Odessa, Tex.
21 Southern Gas Association, roundtable conference on pipeline operations and maintenance, Lamar Hotel, Houston.
23-25 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.
24-25 American Society of Mechanical Engineers, American Institute of Electrical Engineers, fuels conference, Daniel Boone Hotel, Charleston, W. Va.
25-28 National Association of Corrosion Engineers, south central region conference, Mayo Hotel, Tulsa.
26-27 Armour Research Foundation of Illinois Institute of Technology, computer applications symposium, Morrison Hotel, Chicago.
26-27 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.
28 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.
28 American Institute of Chemical Engineers, South Texas section annual technical meeting, Rice Hotel, Houston.
31-Nov. 4 University of Oklahoma, petroleum landmen's institute, Student Union Building, University of Oklahoma, Norman.

NOVEMBER

3 West Central Texas Oil and Gas Association, annual meeting, Hotel Windsor, Abilene, Tex.
3-4 American Association of Petroleum Geologists, Pacific section, annual meeting, Ambassador Hotel, Los Angeles.
3-4 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.
6-9 Chemical Institute of Canada, chemical engineering division, conference, Quebec City.
7-10 Society of Exploration Geophysicists, international meeting, Moody Convention Center, Galveston, Tex.
14-16 American Petroleum Institute, fortieth annual meeting, Conrad Hilton, Palmer House and Congress hotels, Chicago.
14-16 Society of Petroleum Engineers of AIME, Venezuelan sections, fourth annual meeting, Maracaibo, Venezuela.
15-16 University of Kansas, natural-gas pipeline institute, Courthouse, Liberal, Kans.
15-17 Southwest Research Institute, Air Force, Navy, industry propulsion systems lubricants conference, Hilton Hotel, San Antonio, Tex.
18 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.
22 Manufacturing Chemists' Association, tenth semiannual meeting and mid-year conference, Statler Hilton Hotel, New York City.
27-Dec. 2 American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York.

DECEMBER

4-7 American Institute of Chemical Engineers, meeting, Statler Hotel, Washington.
5-7 Interstate Oil Compact Commission, annual meeting, Westward Ho Hotel, Phoenix.
9 Tulane University, School of Law, and American Association of Oilwell Drilling Contractors, fifth annual program on mineral and tidelands law, University Center, Tulane University, New Orleans.
26-31 American Association for the Advancement of Science, annual meeting, New York City.

JANUARY

15-18 Pipe Line Contractors Association, annual meeting, Mark Hopkins and Fairmont Hotels, San Francisco.
16-19 Instrument Society of America, winter instrument-automation conference and exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis.
17-19 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville.
20 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

FEBRUARY

7-8 University of Oklahoma, School of Petroleum Engineering, advanced petroleum engineer seminar, University of Oklahoma, Norman.
24 Natural Gasoline Association of America, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette, La.
26-Mar. 1 American Institute of Chemical Engineers, petrochemical and refining exposition, Municipal Auditorium, New Orleans.
26-Mar. 2 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Chase and Park Plaza Hotels, St. Louis.

MARCH

7-8 University of Oklahoma, School of Geological Engineering, seventh biennial geological symposium, Student Union Building, University of Oklahoma, Norman.
8-10 American Petroleum Institute, Division of Production, southern district meeting, Captain Shreve and Washington-Youree hotels, Shreveport, La.
13-17 National Association of Corrosion Engineers, annual meeting and corrosion show, Hotel Statler, Buffalo, N. Y.
15-17 Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas.
22-24 American Petroleum Institute, Division of Production, southwestern district meeting, Cole Hotel, Albuquerque.
23 National Industrial Conference Board, general session, Shamrock-Hilton Hotel, Houston.
27-29 Midwest Gas Association, annual meeting and convention, Sheraton-Fontenelle Hotel, Omaha.
28-29 University of Oklahoma, Schools of Petroleum and Gas Engineering, gas conditioning short course, Oklahoma Memorial Union Building, University of Oklahoma, Norman.

APRIL

5-7 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Mayo Hotel, Tulsa.
20-21 Society of Petroleum Engineers of AIME, East Texas-Louisiana-Arkansas gas-technology symposium, Tyler, Tex.
24-26 Southern Gas Association, meeting, New Orleans.


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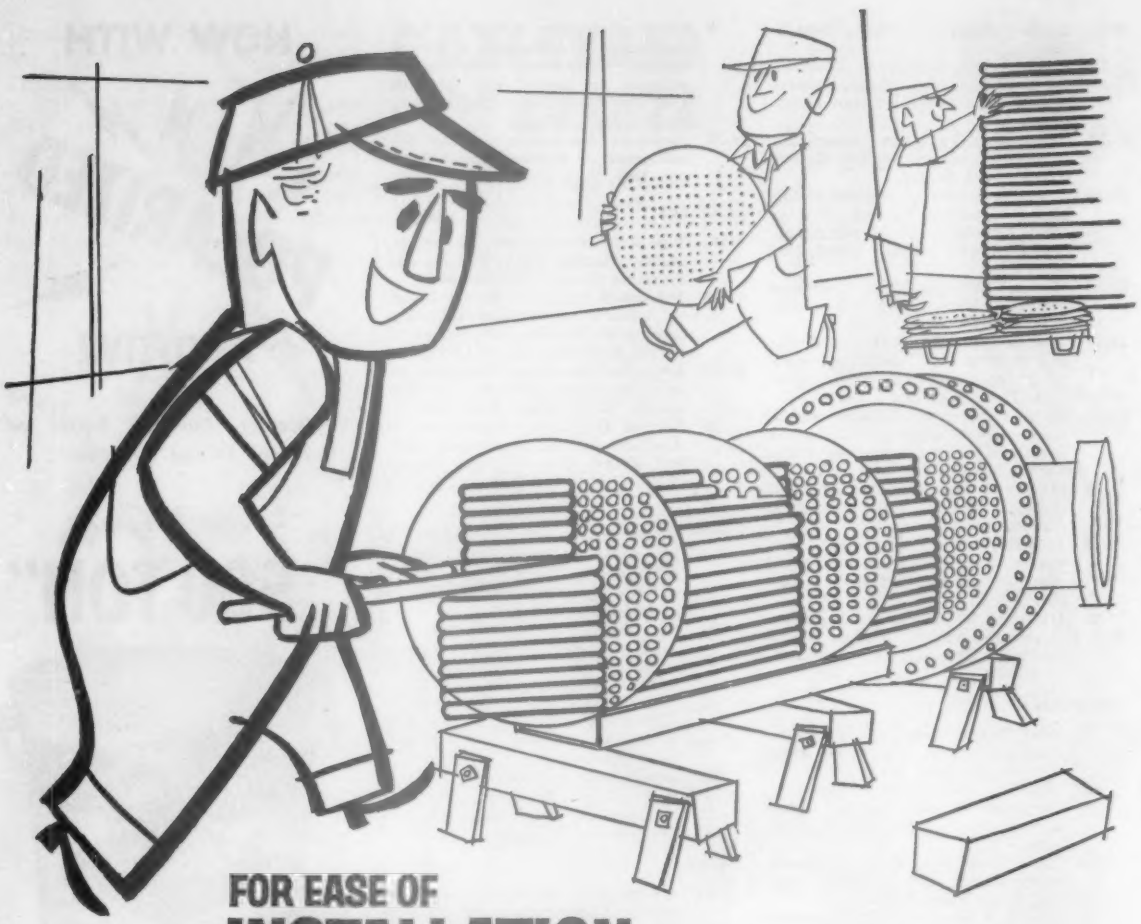

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## *Lectrosonic steel heat exchanger tubing*

**With B&W LECTROSONIC you get . . .**

- an electric-resistance-welded carbon steel heat exchanger tube manufactured to ASTM-ASME standards under a rigid system of quality control and proven by five years of extensive field service
- a dimensionally accurate heat exchanger tube that fits properly into tube sheets and threads easily through baffles
- a welded tube with a new concept of quality, designed specifically for economical long life in heat exchangers

B&W Job-Matched LECTROSONIC Heat Exchanger Tubing is available through a nationwide network of district sales offices and Steel Service Centers. And remember—matching tubes to jobs assures you the *right tube,* in the *right quantity,* at the *right time.* For more information, call your local B&W District Sales Office, or write for Bulletin T-431. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

Steel

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THE BABCOCK & WILCOX COMPANY

**TUBULAR PRODUCTS DIVISION**

TA-9058-WP

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

## 50 years ago

September 29, 1910

Commercial oil production is definitely proved on Vinton salt dome in southwestern Louisiana as joint test of Producers Oil Co. and Gulf Refining Co. comes in flowing 2,000 bbl. daily from 2,100-ft. sand. New field is fourth for Louisiana Gulf Coast. Important production predicted.

Border Gas Co., subsidiary of Producers Oil Co., Houston, is laying a natural-gas line from prolific Reiser field to Laredo and its Mexican counterpart, Nuevo Laredo, where distribution systems also are being put in. The company also has asked the Mexican Government for a concession to extend the 30-mile line 160 miles to Monterey. Reiser, the country's most southerly field, is reported to have sufficient gas capacity to supply the whole state of Texas with fuel.

## 25 years ago

September 26, 1935

Failure of California operators to cooperate in program to curtail rapidly mounting production threatens state's oil market with drastic slashes. Urgent telegraphic appeals to all producers to cut output go unheeded. State's oil output climbs to 643,750 bbl. daily, the highest level in 5 years.

Lone Star Gas Co. rushes completion of 20-in. gas line from Long Lake and Cayuga fields in Anderson County, East Texas, to Dallas. New 110-mile line, with capacity of 110,000,000 cu. ft. daily and costing $2,500,000, is company's largest construction project since 1929. New plant with daily capacity of 100,000,000 cu. ft. also is being built to process gas from both fields.

## 10 years ago

September 28, 1950

Newly formed United States Pipe Line Co. reveals plans for first independently owned and operated common-carrier pipeline for petroleum products. New line, originating from feeders in the large Houston-Beaumont-Port Arthur refining area on the Texas Gulf Coast, will serve the St. Louis-Chicago consuming areas.

Fast-developing Ringwood field in Major County, Oklahoma, takes top spot in Mid-Continent's oil activity with 115 wells completed, 35 drilling, and more than 20 locations staked. New addition of 28,000 acres boosts field's productive area to 40,000 acres. Limits of field are still undefined.

Producers in spreading Canyon Reef fields of Scurry and adjacent counties in West Central Texas launch plans for giant pressure-maintenance project.

# JOURNALLY SPEAKING

### "... and now, a word from our sponsor"

IF YOU were watching television right now, you would probably get up at this point and open a can of beer, because this is a commercial.

Now, don't get panicky. This isn't strictly a commercial. It's more of a commercial ABOUT commercials—the ads which are a part of the magazine you're holding in your hand.

This commercial will be short and to the point—I figure 3 minutes ought to just about get you through it and on to the next page. The commercial isn't going to tell you that advertising is necessary so the magazine can be published; that subscriptions will not begin to pay for the cost of printing the Journal, or that taxes and such take so big a slice of the loaf that little is left over at the end of the year. This commercial isn't going to tell you about that because it wouldn't make much difference to you, anyway. You've got your own problems. This commercial IS going to point out, however, that those ads are in there for you to use, not skip over.

Most oil men make good use of the advertisements in the Journal. They notice the ads which touch their field and this helps them keep up with developments in their end of the business. But for some readers the advertisements are just so many pages to wade through before getting to the editorial section. These folks may wonder if all those ad pages are really necessary.

Well, if you've been ignoring the ads in the Journal, you've been cheating yourself. The Journal is pacemaker for the industry. Every issue you pick up should tell you something you didn't know before, or we wasted the efforts of several hundred people in bringing it to you.

If you limit your search for these new things to the editorial pages and skip the advertising, you're eliminating an area of high potential. Any oil man knows you don't give up on a prospective producing area until you've made a few tests and maybe drilled a wildcat or two. Somewhere in the Journal's advertising pages, you may find your own Spindletop.

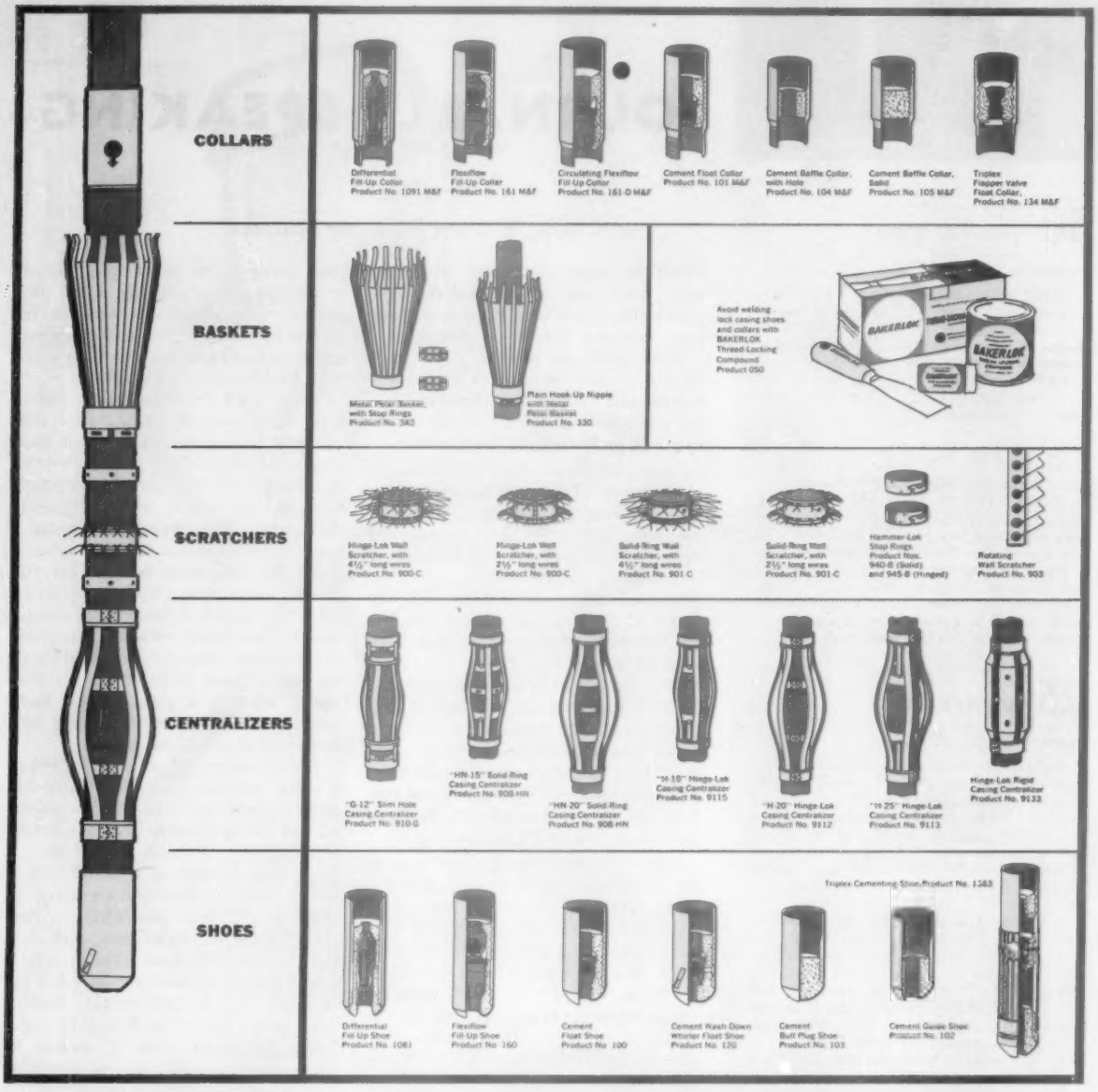
You don't think so? Okay, here's how to run your own exploration tests on what may have been barren territory until now. Turn to the front of the book and start looking through the ads. You will realize suddenly that every company who has rented a page of the Journal for this issue is doing his dead-level best to tell you about some new product, describe some new aspect of his service, explain how he has produced some new piece of equipment with certain qualities, or lay out for you some of his choicest wares. Give it a good, honest look, and you will find new things and new facts you didn't know before.

It isn't surprising, of course. When a valve company, say, forks over its money to use one of the Journal pages, it's not going to waste that space telling you that 5 years ago it had a valve that would have saved you a lot of money. Instead, it's going to show or tell you just what its best valve looks like right now, and then tell you why it's best. The company might point out that it's designed for strength, but is lightweight, that it has a new kind of handwheel to make operation easier, that it comes in such-and-such size and is available with socket weld and screw ends.

Now, maybe you aren't interested in valves, but you're interested in SOME phase of the oil business, and right here in the Journal—editorial and advertising pages—you'll find the latest information available on it.

So if you hear somebody grumble about all those ads in the Journal, you can bet your tin hat he's **skipping** them, not **using** them.

*—Max Batchelder*


COLLARS
Differential Fill-Up Collar Product No. 1091 M&F
Flexiflow Fill-Up Collar Product No. 161 M&F
Circulating Flexiflow Fill-Up Collar Product No. 161-D M&F
Cement Float Collar Product No. 101 M&F
Cement Baffle Collar, with Hole Product No. 104 M&F
Cement Baffle Collar, Solid Product No. 105 M&F
Triplex Flapper Valve Float Collar, Product No. 134 M&F
BASKETS
Metal Petal Basket, with Stop Rings Product No. 343
Plain Hook-Up Nipple with Metal Petal Basket Product No. 330
Avoid welding . . . lock casing shoes and collars with BAKERLOK Thread-Locking Compound Product 050
BAKERLOK
SCRATCHERS
Hinge-Lok Wall Scratcher, with 4½" long wires Product No. 900-C
Hinge-Lok Wall Scratcher, with 2½" long wires Product No. 900-C
Solid-Ring Wall Scratcher, with 4½" long wires Product No. 901-C
Solid-Ring Wall Scratcher, with 2½" long wires Product No. 901-C
Hammer-Lok Stop Rings Product Nos. 940-B (Solid) and 945-B (Hinged)
Rotating Wall Scratcher Product No. 903
CENTRALIZERS
"G-12" Slim Hole Casing Centralizer Product No. 910-G
"HN-15" Solid-Ring Casing Centralizer Product No. 908-HN
"HN-20" Solid-Ring Casing Centralizer Product No. 908-HN
"H-15" Hinge-Lok Casing Centralizer Product No. 9115
"H-20" Hinge-Lok Casing Centralizer Product No. 9112
"H-25" Hinge-Lok Casing Centralizer Product No. 9113
Hinge-Lok Rigid Casing Centralizer Product No. 9133
SHOES
Triplex Cementing Shoe, Product No. 1363
Differential Fill Up Shoe Product No. 1081
Flexiflow Fill-Up Shoe Product No. 160
Cement Float Shoe Product No. 100
Cement Wash Down Whirler Float Shoe Product No. 120
Cement Bull Plug Shoe Product No. 103
Cement Guide Shoe Product No. 102

# Good primary cementing equipment makes sense

**THERE ARE TWO WAYS** to buy primary cementing equipment—by quality and by price. Both are important.

Still, some operators don't shop for quality. They feel that primary cementing is a more or less routine operation. So any shoes, collars, centralizers, scratchers, baskets are good enough.

**IN OUR OPINION** (and plenty of operators agree), primary cementing is never routine. You've got just one chance to get a good primary cement job. So it makes plain good sense to invest in the most advanced equipment you can get.

Any remedial operation that comes later not only comes at high extra cost—it is never as satisfactory as a primary cement job that's done right in the first place.

**THE BEST OF MODERN ENGINEERING** is built into Baker Primary Cementing Equipment—yet prices are competitive. Here is equipment you can depend on.

Get Baker Primary Cementing Equipment from your Supply Store. Get help on primary cementing problems from your Baker Serviceman.

**BAKER PRIMARY CEMENTING EQUIPMENT**

*The one complete line available through your* **SUPPLY STORE**

**BAKER OIL TOOLS, INC.** HOUSTON / LOS ANGELES / NEW YORK

Available worldwide. Sold only through Supply Stores in U.S. and Canada.

Supply Store stocks are backed by stocks in 64 strategically located Baker field warehouses.

# Not a time to sigh but a time to serve

MUCH OF THE OIL INDUSTRY has made its recovery from the late "recession." Not so the contract-drilling segment; it has been sinking even deeper into economic distress.

For many, making a reasonable profit is no longer the immediate goal. Rather the struggle is simply to stay in business. Some haven't managed even that.

So, it isn't surprising that the air is filled with cries of pain from drilling contractors. Their distress is genuine. Most of the causes of this grief are beyond the contractors' power to remedy—either individually or collectively through their organization, the American Association of Oilwell Drilling Contractors.

STILL, EACH of the contractors must take care he is not so blinded by his predicament that he does not do what he can to improve his lot.

The contractor need not, and must not, concentrate simply on surviving the crisis. Instead, he can take positive action. He can serve his customer better. He can make a dedicated effort to cut the cost of drilling for the oil company paying the bills.

The oil companies have only so much money to spend for new wells; if each well is cheaper, more will be drilled. More wells drilled mean more rigs at work.

What can the contractor do? First, he can make certain he uses the drilling practices which yield the fastest penetration and lowest cost on footage-drilled holes. He can adopt new ideas as they come to light.

The contractor can make certain that the operator gets a full 24 hours work out of the rig when it is on day work. Every man on the rig should be educated to see that the dollar he saves for the oil company today will be a dollar earned for the contractor tomorrow.

FINALLY, THE CONTRACTOR can evangelize among the oil companies themselves, inducing them to abandon outdated and wasteful practices which bloat drilling cost.

For instance, the contractor could influence an operator to accept a higher angle of hole deviation in crooked-hole country. Result would be faster drilling and a well which would be just as serviceable but much cheaper. Or, the contractor could use his influence to get cheaper, though equally effective, blowout-preventer hookups and mud systems. He could even take the initiative at times in proposing turnkey-drilling deals where they would be obviously cheaper than the usual footage contract.

Oil companies need an aggressive and progressive drilling partner in meeting America's future energy requirements. A sincere effort by contractors to save money for the operators won't solve all the problems but it will help. When they do this, it will be up to the operators to make sure contractors get a fair shake.

**Monel alloy sheathing protects against tidal zone corrosion** of structure supporting first permanent drilling platform off California shore. Platform is jointly owned by Standard Oil Company of California and Humble Oil and Refining Company. It was fabricated by National Steel and Shipbuilding Corp., San Diego, California.

## Supporting California's first permanent offshore platform...

# sea legs defended from corrosion with Monel*

Key concept in this offshore drilling platform is *permanency.*

It's designed not only for drilling but also for year-after-year *production* of up to 25 wells.

Jointly owned by Standard Oil Company of California and Humble Oil and Refining Company, the platform is located two miles off Summerland in 100 feet of sea water. An unusual 140-foot derrick rigged for dual operation permits drilling two wells at a time.

### Structure is built to last

In designing the platform, considerable attention was paid to the problem of preventing sea water corrosion of the supporting structure. For about 10 feet... in the critical splash and tidal zone where painting is impractical and cathodic protection is non-continuous . . . all vertical and cross members are sheathed with Monel nickel-copper alloy.

Experience on the Gulf Coast and with radar islands has shown that in this critical zone Monel alloy sheathing offers the best and least expensive corrosion protection.

### When made of Monel alloy many items of equipment last longer

Monel nickel-copper alloy is ideal for equipment exposed to the corrosive conditions common in oil fields . . . salt water, acids, sour crudes. In instrument parts, screen cloths, polished rods, valves, pump parts, many other items, Monel alloy is widely used.

An Inco booklet "Metals to Make Petroleum Equipment Produce More", goes into details. We'll be glad to send you a copy.

*Inco trademark

**HUNTINGTON ALLOY PRODUCTS DIVISION**

The International Nickel Company, Inc.
Huntington 17, West Virginia

**MONEL**

# Idle Rigs Keeping Pressure on Drillers

• Journal survey shows there are twice as many rigs as needed for today's drilling programs. But some suppliers think as many as 80% of the surplus may be unusable. Despite lack of rig sales, the parts business is still good.

THE domestic drilling industry is still going through the economic wringer.

But many contractors and supply men believe it will emerge from its present troubles in 2 or 3 years, stronger and more efficient.

Rigs will be fewer in number but bigger and faster; and they will be owned by larger, better financed, and more experienced operators.

These impressions were gleaned by Oil and Gas Journal editors in talks with drilling people over the country.

The current rig situation is this:

Total of all rigs owned by contractors in the U. S., as reported to The Journal, is 3,397, a 13.5% drop since 1957. These tools are owned by 23.5% fewer contractors with indications that at least 286 have left the business since 1957. (See p. 150 for full details.)

While contractors are carrying 3,397 rigs on their books, only an average of 1,732 has been working regularly so far this year. This would mean that on the average 1,665 rigs have been idle.

In the first part of the present drilling recession, this tremendous capacity of idle rigs depressed drilling rates, practically froze supply-house sales, and attracted green competition into the business with the lure of getting a rig at a distressed price and going to work.

But this may be changing.

Many oil men assert the number of workable drilling rigs is vastly overstated. They claim many of these rigs are junk; some too old to drill, others stripped of vital components to keep other rigs running. The rigs may be carried on some contractors' books but they aren't able to work.

One contractor went so far as to predict that any sudden real spurt in the drilling business would set off a record buying spree as contractors tried to get idle rigs back in shape.

## What some suppliers are saying:

"I can't remember when we sold a new rig, except for use in other lands."

"Since the first of the year, we've sold six rigs—four to India and two for use in Libya—no domestic rigs."

"There is lots of replacement buying going on—new tables, new swivels—I think that some contractors have robbed their own equipment to the bone."

"Can't be any large pickup of sales until drilling picks up, and until the excess rigs have been worked off."

"Some people are coming to the end of their rope in robbing their own equipment. Especially is this true of drill pipe. We've been having some feelers on drill pipe, and I think there'll be a return to the market there."

"There's probably not 20% of these rigs which are put out as idle that could be used anywhere. It's bad psychology for the contractors."

"I don't think any new individuals are buying up old rigs and getting into business, undercutting others on prices. I think now only the bigger contractors can afford to stay in business and they're battling to keep alive."

**What's happening . . .** Most of the surplus rigs are older tools or equipment capable of drilling to shallow or medium depths above 10,000 ft.

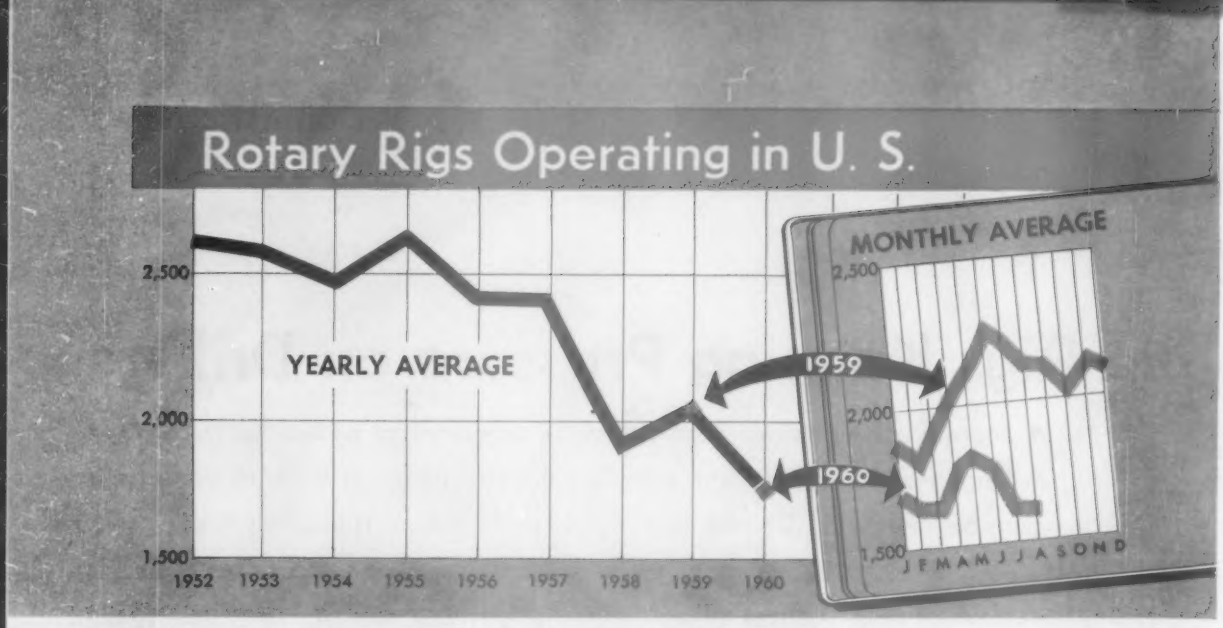
The bigger rigs generally are keeping busy and nearly all the off-shore equipment has work.

The idle rigs are stacked in contractors' yards across the oil country or on supply-house lots where they have been repossessed or taken in with trades. Majority of the ones able to work are for sale.

A sign of the times is the recent sale at auction of the equipment of two drilling firms. One was an eight-rig outfit and the other a two-rig firm. Supply men believe these two sales are among the rare times a contract driller has sold his equipment at auction.

Some fantastic deals for old equipment are being reported. A Tulsa contractor said he was offered seven rigs by a supply house for $300,000. One of them was a 12,000-ft. rig; and drill pipe and collars offered with the tools were worth $125,000 alone. Payment could be made at rate of $100 per rig per day for only the days worked. At this rate, he said, it would pay the Tulsan to stack his own rigs and work the idle ones offered him.

A South Louisiana contractor re-




**IN THE CHART:** Activity of rotary rigs is on the decline again after enjoying a slight rise last year. Average for first 8 months of 1960 is 1,732 active rigs compared with 2,051 for same period last year.

cently sold three steam rigs plus drill pipe and some casing to an equipment rental firm for about $60,000. The tubular goods alone were worth nearly that. An inland drilling barge sold on the Gulf Coast for $75,000. That was knocked down from an original sales price of $300,000.

A Dallas supply-firm official reported the market is flooded with used rigs. He said there is little trouble getting a reasonable price for the newer used equipment. Many of the rigs, however, are from 12 to 20 years old. They are hard to sell and going at less than they're really worth.

He admitted it's often difficult to estimate what a rig is worth. His best rule of thumb is a value of $100 per horsepower with variations up or down depending on age and condition.

A Midland contractor reported used rigs were getting hard to turn there at a reasonable price, and a Tulsa supply man declared few new individuals are buying old rigs to get into business.

"Only the bigger contractors can afford to stay in business—and they are buying almost altogether in the second-hand market. No one's going in the drilling business nowadays. The contractors are battling to keep alive themselves," he said.

Other supply firms also said they weren't selling used rigs to newcomers these days. Their sales are to the established operators who are better credit risks. These men buy the rigs to upgrade their own equipment, to replace a worn-out rig, or to ship abroad.

**Rig economics . . .** The large number of rigs on the used market has practically halted sale of new rigs.

One supply-house official said "you can count on your hand the number of new rigs sold for use in this country this year." Any new rig sold usually is ticketed for foreign operations.

Suppliers realize that the contractor cannot buy a new rig, operate it at today's contract prices, and depreciate the equipment before it is worn out. That's the basic reason little new equipment is being sold.

Sale of new parts, of components such as draw works, blocks, pumps, etc., or a new string of drill pipe remains fair to good. But sale of a complete new rig is a rarity.

Actually the drill pipe is a controlling factor in the used rig market, too. A driller can operate a used rig on a shoestring until his drill pipe wears out. Or he might be able to get a used rig for nothing; but if he needs drill pipe to operate it, that's another matter.

Supply-house credit men take a closer look at a customer's credit when sale of drill pipe is involved. A new string costs $75,000 up. The supply house has to pay cash for the material and can't afford to turn it over to a contractor with shaky credit. This is particularly true when a contractor's rig often isn't worth as much as the drill string.

Most of the component sales these days are to "heavy up" a rig. The contractor is converting his rig to deeper duty or capability a piece at a time. He may first buy a bigger pump, then perhaps a hoist, later other items until ultimately he has a rig that can go much deeper. This permits him to bid on the more lucrative deep-hole business.

Some contractors are doing the same thing with distress rigs they are able to pick up at a "steal" price.

**The cannibals . . .** Contractors are cutting corners wherever possible, making old equipment do, and cannibalizing one rig to keep another going.

Supply-house people report there is "more cannibalizing than ever before," and the practice is one reason why contractors don't come to their stores more often for new items.

"I know of one contractor who has 17 rigs," a supply man said. "He's pulled seven of them into the yard and is stripping them piece by piece. He's using them to keep 10 rigs going and is peddling parts.

"I know of another contractor who is hauling a $1,500 piece of equipment from North Dakota to Oklahoma rather than buy the equipment locally. He'd rather pay the freight than buy new."

Contractors also buy old draw works for nearly nothing and strip off the usable parts to repair their own draw works. Others will truck a drill string 800 miles to a new well whereas formerly they would buy pipe ordered delivered to the well.

Some shallow-well contractors are buying retired strings of drill pipe 12,000 to 14,000-ft. long. They break up the strings, take the best joints and make up perhaps one or two good strings 3,000 to 4,000-ft. long.

A few supply executives, while admitting that contractors have been cannibalizing old rigs for several years now, still doubt that this practice has eliminated any significant number of

rigs. Even the rigs that have been salvaged by these means aren't getting enough work to wear them out, these men contend.

Others, however, feel that contractors have cut their equipment to the bone, and the time isn't too far off when many of them will have to start buying new equipment or get out of the business.

**New trends . . .** One casualty of current drilling trouble is steam rigs. They now are practically dead.

Until recently the old steam units—more than 100 of them in the Gulf Coast region—had been kept fairly busy. They long ago had been depreciated and for this reason could drill cheaply.

With so many power rigs now available for work, the old steam units have become uneconomic. A power rig can operate on about half as much gas as the steam rig. Operators now are more often having to pay 25 to 26 cents per M.c.f. for gas which makes the steam units too expensive. They're also too costly to move.

One contractor reported that more and more of the companies in their bid letters are asking for power rigs. Part of the reason for this, he said, is that many of the old steam units don't have large enough pumps to provide the mud hydraulics the oil companies want in drilling.

A number of the steam rigs are being converted to straight mechanical or to diesel-electric drives. A contractor can adapt a steam hoist for use as the drawworks on a diesel electric by changing the pumps and engines. If switching to straight mechanical drive, the draw works will have to be changed too. This switching, however, is not a major trend because the adaptations require too large an outlay of capital.

Other trends noted:

**. . . Inland drilling barges** are a drug on the market. Many are stacked in the coastal areas.

**. . . Big rigs** capable of deeper drilling are not too much in surplus generally except in West Texas. Operators in the Permian basin apparently are drilling fewer holes below 10,000 ft. because many of the big rigs in that region are idle.

**. . . West Texas** operators report more trouble in getting pipeline connections for oil and gas and in some instances are unable to get FPC approval for gas-sales contracts. This in turn hurts the drilling contractor because it discourages new drilling.

**. . . Skid rigs** are often being converted to trailer jobs. This gives them more mobility and quicker rig up and down.

**. . . Quality of equipment** and credit standing of the drilling contractor are beginning to mean more in bidding for company jobs. More majors like to see the rig in action before admitting a contractor to the bidding. This practice is weeding out a great number of the marginal contractors.

**. . . Swing to turnkey** drilling jobs is growing. This type of contract is now favored by Gulf, Pan American, British American, and Mobil. It takes a contractor with strong credit to handle some of these deals.

One contractor reports he will have nearly $400,000 per rig invested in a turnkey job before he gets paid. On one small job, he drilled an 8,000-ft. well, provided three casing strings, paid for cementing, completion, servicing, logging, coring, testing, mud, water—everything including roads to location. Price was nearly $100,000 with payment due 90 days after completion.

**The outlook . . .** Most contractors and supply men agree that it will take the industry from 2 to 3 years more to work off the surplus of rigs.

But buying of some new equipment probably will pick up soon.

Many rigs are so stripped or old that when the jobs come, they'll need parts to work. Many others which could go to work immediately would have trouble maintaining a prolonged pace without major overhaul.

One optimistic supply man declared that not more than 20% of the rigs now carried as idle could be put to work if needed. "We've robbed Peter to pay Paul, and we're approaching the point where we can go no further," he said. "We've got to replace this junk with new stuff. When? Around the first of the year or anyway during next year."

Another estimated it will take 3 more years to work off the rig surplus. He observed:

"When it's over the rigs will be in lots fewer hands than today. And there may be fewer supply houses around too."

# Humble, Monterey Talk Merger

**• Humble would get some more California crude in the deal and a part interest in Transwestern Pipeline.**

HUMBLE Oil & Refining Co. last week admitted it has been courting Monterey Oil Co., a Los Angeles producing and exploration firm.

A terse announcement from both companies confirmed what the industry has been talking about for months—that Humble may buy Monterey. The deal reportedly will be a cash purchase and apparently is in the final stages of negotiations.

Buying Monterey would be another step in the Standard Oil Co. (N. J.) master plan to get bigger on the West Coast. Jersey, through Humble, has had exploration and production offices on the West Coast since 1948 and only this summer bought its first service stations (OGJ, June 27, p. 81).

The deal with Monterey won't fill Humble's biggest need on the West Coast, more service stations, but it would add 7,075 bbl. daily production to Humble's present California production of 9,000 bbl. daily. And building up crude production on the West Coast could lead to product exchange deals or processing arrangements which would eventually get gasoline to Humble stations without going to the expense of building a refinery.

**Monterey's assets . . .** Monterey's two biggest attractions are a daily crude production of 15,000 bbl. and a 15.8% ownership in Transwestern Pipeline Co., a gas transmission company which recently started moving gas from the Southwest into the Los Angeles area (see related story p. 106).

Monterey's crude production is split about 50% in California, 30% in Texas, and the remainder in Louisiana, New Mexico, Oklahoma, and Wyoming. The company also has daily gas production of about 10 million cubic feet.

Monterey's assets of roughly $102 million also includes part ownership in three gasoline plants: The Snyder plant at Sacroc unit in Scurry County, Texas; the Fullerton field plant, Andrews County, Texas; and a plant at Huntington Beach field in California. Production from these plants averaged 7,190 bbl. daily in 1959.

**Offshore . . .** Monterey has been one of the more active companies in California's offshore oil play.

The company, in a joint venture with Texaco Inc., has developed a 30-well field off Orange County at Seal Beach.

The company's management is headed by an executive committee which includes Frederick L. Ehrman, chairman; Howard C. Pyle, president; and John R. McMillan, executive vice president. McMillan is credited with being one of the early organizers of Transwestern Pipeline.

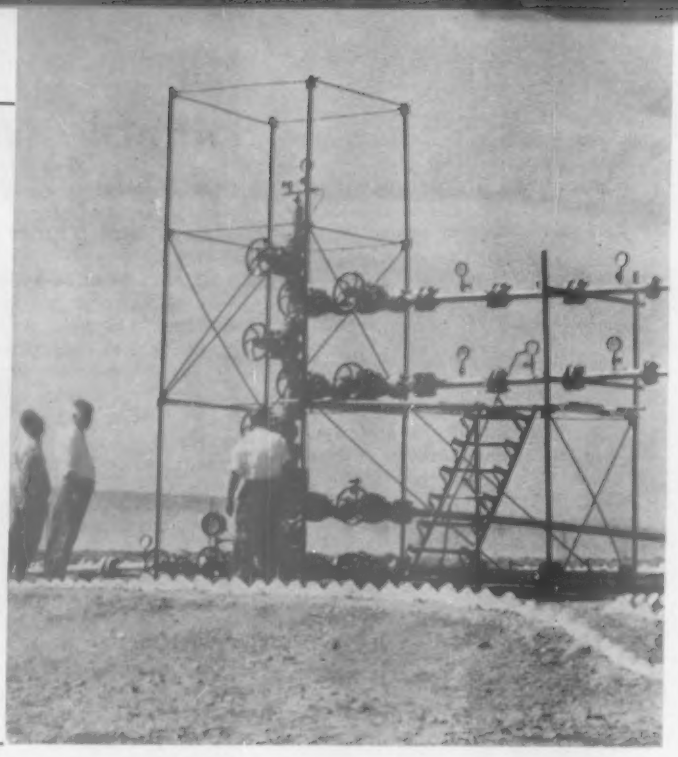
## These photographs came back

. . . But in a way they're unusual. Many didn't.

Most of the American oil men who toured Russia shot oil scenes when their Russian hosts permitted. But when they had their films developed in this country, many were blanks.

The Russians "surreptitiously," says Jersey's George Piercy, exposed the films. In the case of one traveler, two-thirds of his efforts were lost to hidden X-ray machines or some device which exposed the film while the oil men carried it.

The lower right photo on page 103 was taken by Piercy. The others were made by W. W. Keeler of Phillips Petroleum.



**TALL CHRISTMAS** tree has four takeoffs at a high-pressure gas-condensate well in Karadag field 24 miles from Baku. High wind is blowing, just like the Texas Panhandle.

# Russians Will Get Better Treatment

RUSSIAN oil men will get the red-carpet treatment during their month-long tour of America's oil country starting October 10.

Despite the charges in Moscow that the American petroleum group touring Russia recently contained spies, the American oil industry went ahead with plans for a friendly, cooperative tour for Soviet oil men.

The Russians will have more freedom and will be subjected to less annoyance than the Americans encountered. Returning American oil men revealed incidents in Russia of excessive customs inspections, photographic film exposed secretly, luggage examined in their absence, and seats with poor views on Soviet airplanes.

W. W. Keeler, Phillips Petroleum Co. executive who headed the American delegation, said he was puzzled by the spy charges and labeled them propaganda.

"I had an understanding with the Russian authorities on the itinerary and we followed it exactly," Keeler said. "We checked with our hosts before taking photographs and took pictures of only what was permitted."

The Americans generally agreed that they had excellent relations with their hosts.

One member of the American group didn't return. Whitney M. Elias, vice president for production of Pan American Petroleum Co., Tulsa, died suddenly in Paris on September 22 (see p. 289). He had left the group for a European vacation.

**The return visit . . .** Plans for the Russian tour of this country are based on this policy:

The Russians will see what the Americans were permitted to see in Russia—and no more, if possible.

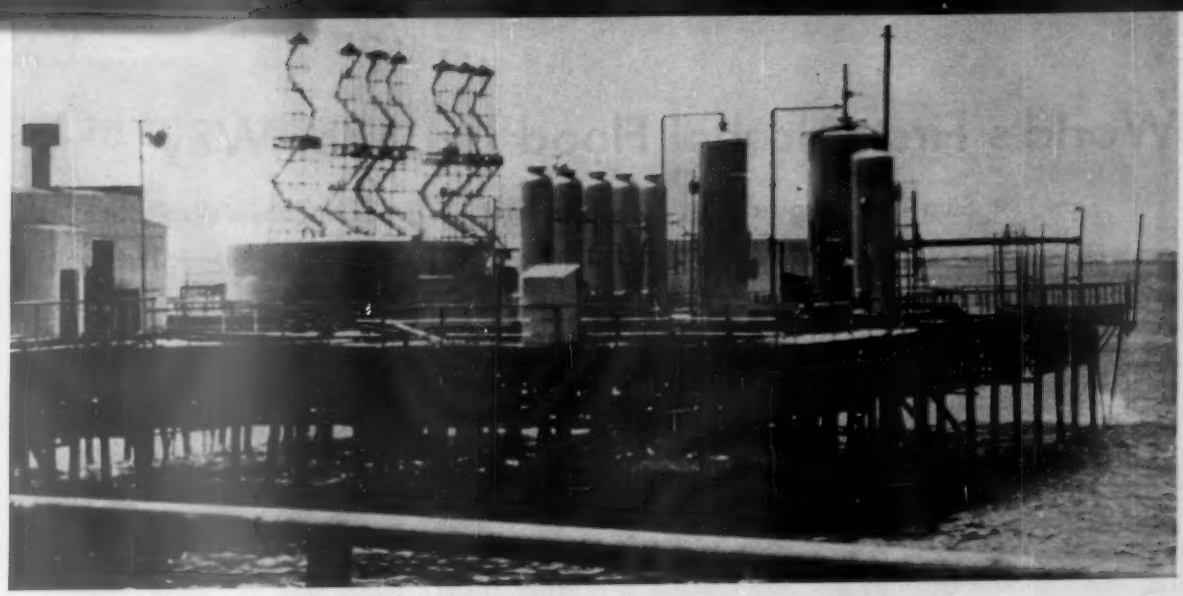
## Where Soviet Oil Men Will Visit

**OCTOBER**

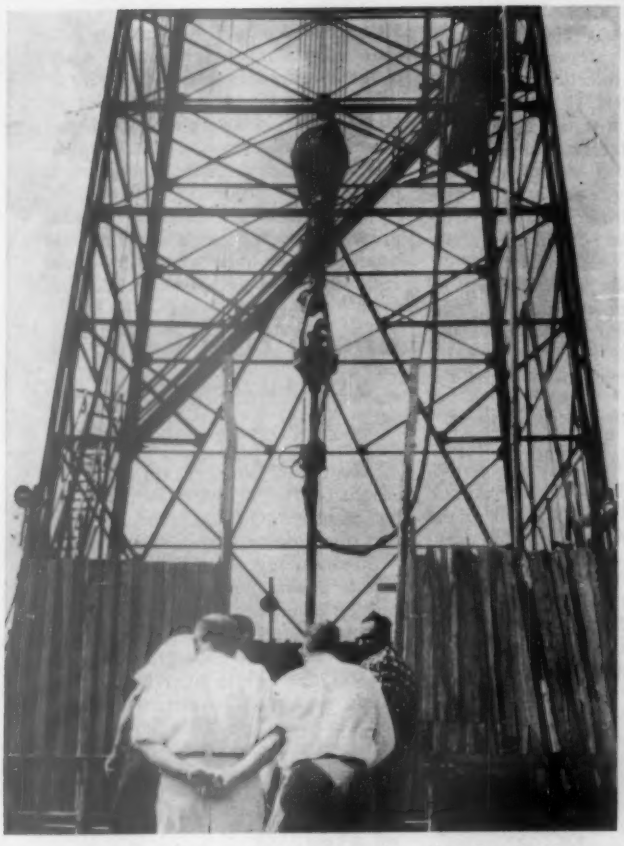
10—Arrive New York City.
11—Briefing at API headquarters and greetings by members of American group who went to Russia.
12—Esso Research Installation, Linden, N. J.
13—Mobil Oil Co. refinery, Paulsboro, N. J.
14—Tidewater refinery, Delaware City, Del.
15-16-17—Washington, D. C. This stay will include visit to and discussions with Bureau of Mines offices, etc.
18—Fly to New Orleans, thence by cars to Morgan City, La.
19—Visit Continental Oil Co. offshore operations.
20—Drive to Lake Charles, La.
21—Visit to Cities Service refinery at Lake Charles.
22—Fly to Houston.
23—Sunday rest.
24—Visit Rice University.
25—Fly to Austin and visit Texas Railroad Commission.
26—Fly to Midland, Tex.
27—Go by bus to Spraberry field.
28—Fly to San Francisco, probably by way of Amarillo and Los Angeles.
29-30—Rest and sightseeing.
31—Visit Standard of California's Richmond refinery.

**NOVEMBER**

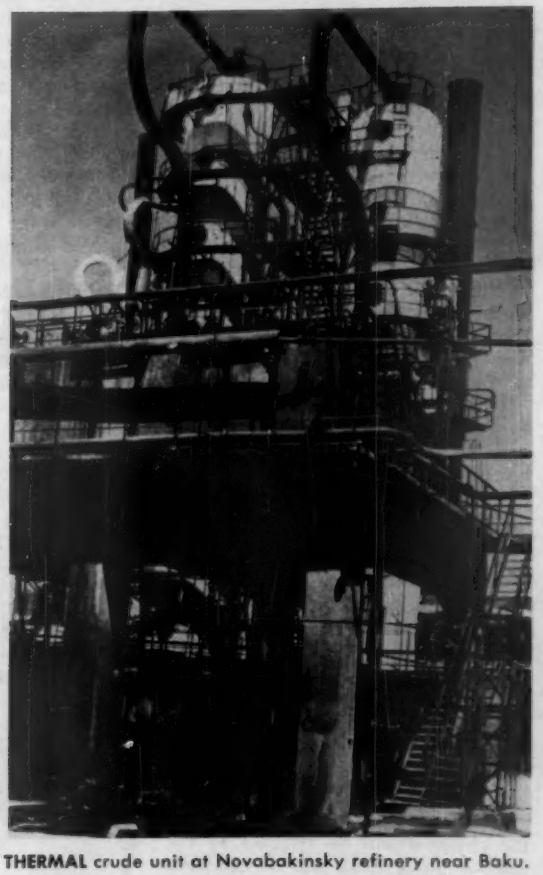
1—Visit Elk Hills field.
2—Fly to Tulsa.
3—Go by bus or car to Bartlesville to visit Bureau of Mines field station.
4—Fly from Tulsa to Kilgore, Tex.
5—See East Texas field.
6—Fly from Dallas to Pittsburgh.
7—Visit a Pennsylvania field.
8—Go to New York.
9-10-11—Sightseeing, review their observations with API.
12—Depart for Moscow.



**GAS SEPARATOR** at Artyom area in offshore part of Russia's Baku field.



**TURBO-DRILL** in operation at well in Karadag field.



**THERMAL** crude unit at Novabakinsky refinery near Baku.

The Russians will be treated as guests, however, and it is the intent of the sponsors that they will receive correct treatment at all times. That means no small-time insults or other actions which might be embarrassing.

Regarding the swap of oil visits, each side submitted a list of places and things it would like to see. These were approved or changed by each country.

Once the broad terms for the visits were agreed upon between the two, most of the remaining details were left up to the sponsoring organization—in this case, the API.

Frank Dennis, of the API Washington staff, will travel with the Russians. He will probably have a professional tour-agency representative along to take care of travel details.

# World's First Alcohol Flood Is Under Way

**• Slug process graduates from laboratory as five companies make attempt to sweep out reserves in Pennsylvania field. Results of the historic test can't be pinned down for more than a year, but hopes are strong.**

THE world's first large-scale field test of alcohol flooding was launched last week in the Bradford field of McKean County, Pennsylvania.

The pilot project has attracted worldwide interest because of tremendous potential-crude reserves which would become available if it is successful.

Alcohol-slug process for increasing oil recovery has been known for several years, but thus far experiments have been confined to research laboratories.

The field experiment is being conducted as a joint five-company operation. South Penn Oil Co. is the operator, supplying the equipment, land, men, and most of the money. Four other participants are Quaker State Oil Refining Corp., Kendall Refining Co., Wolf's Head Refinery, and Bradley Oil Co.

It will be a tertiary-recovery method for Bradford field and will be used in a section of the field where water flooding has been in operation ever since primary production became uneconomical. Water flooding also is now becoming uneconomical on this particular property.

Operators hope that the alcohol-slug process will sweep out the remaining oil reserves. Bradford field reserves are estimated at 52,268,000 bbl. Its production last year was 4,826,000 bbl. with cumulative production since discovery estimated at 604,732,000 bbl.

**The project . . .** A typical five-spot injection plan is being used with eight additional wells outside the square expected to be affected by the alcohol flood (see chart).

South Penn Vice President R. W. Grunert said in Oil City, Pa., that impure isopropyl alcohol is being used. A near-pure grade of isopropyl was also considered but finally rejected because of difference in cost. The impure grade costs $10.50 per barrel compared to $17.50 per barrel for the near-pure grade.

The alcohol is trucked to the site and stored in eight 100-bbl. tanks. Alcohol-injection rates are based on the former water-injection rates of 23 bbl. daily.

Plans call for injecting 27,000 bbl. of alcohol at total rate of 100 bbl. daily spread over the four injection wells. Injection pressure is 1,100 psi. Depth of the Bradford Third sand which is being injected is about 1,400 ft.

Officials estimate 9 months will be required to complete injecting the alcohol. The alcohol slugs will be followed by water. Another 6 to 8 months will be needed to check the collected data.

**The process . . .** The slug of isopropyl alcohol acts as a miscible piston.

It completely displaces both oil and water until the alcohol content of the mixing zone falls below the concentration needed to maintain miscibility. When miscibility is lost, the process reverts to a water flood.

The research of Cart Gatlin and R. L. Slobod at Penn State University also has shown that two other alcohols may be substituted for isopropyl, which is considered the best basic material.

Methyl alcohol may be used at the front and rear of the slug, acting as buffer zones to protect isopropyl from water dilution.

A third process involves normal butyl alcohol.

**Historic area . . .** This is not the first time that oil history has been made in the Bradford field area.

Water flooding, the granddaddy of all secondary-recovery methods, was discovered there about 1880. The field was discovered in 1871 and reached peak primary production in 1881.

Water flooding reached large-scale proportions by the early 1900's. Field production climbed steadily from 1906 under the stimulus.

## How South Penn hopes to flood with alcohol

BRADFORD field's alcohol-slug flood consists of one producing well surrounded by four alcohol-injection wells on the corner of a square.

Eight additional oil wells outside of the five-spot will be affected by the alcohol flood. Data will be collected as the experiment progresses on each one of the nine oil wells and the four injection wells.

The area outside the pilot project will remain in operation under water flooding.

## Cheap Fuel Cell

**. . . for commercial use is aim of researchers.**

AN AGREEMENT for joint research on fuel cells has been reached by Standard Oil Co. (Indiana) and McGraw-Edison Co.

Standard Oil researchers will contribute information on catalysis, combustion oxidation, and hydrocarbon or petroleum fuel characteristics. The Edison Research Laboratory division of McGraw-Edison at West Orange, N. J., specializes in electrochemistry, cell reactions, electrode construction and electro-chemical cell building.

The joint project seeks a cheap and practical method of oxidizing hydrocarbon, alcohol, or hydrogen as fuel for a cell.

A few experimental cells for conversion of fuel to electric energy have been developed, but none has met the requirements for economical production of power adaptable to commercial use.

Standard Oil and McGraw-Edison officials say an efficient fuel cell would give greater efficiency than gasoline engines, plus more versatility.

# Oil men are putting more miles on their automotive fleets

- Cost-cutting program finds companies keeping their cars longer, driving them farther. Compacts are still thought of as experimental.

OIL companies are driving company cars and trucks more miles and keeping them longer before trading for new equipment.

A recent survey of leading oil firms reveals they are extending the average mileage life of units by 16,000 to nearly 30,000 miles.

The trend:

One major has established a retirement deadline for motor units at 100,000 miles or 4 years' service.

Another has a flexible policy of keeping units 36 months or longer but has a mileage target of 75,000 to 80,000 miles.

A third has extended its retirement scale to 36 months or 65,000 to 80,000 miles.

About one-third of the companies polled have made substantial extensions of the use life of their cars and trucks.

A similar poll 5 years ago found that most companies swapped cars for new ones every 2 or 3 years or at 45,000 to 60,000 miles.

**Other trends . . .** The new survey also shows that oil companies:

**. . . Still prefer standard shifts** to automatic transmissions, but only by a narrow 6% margin.

**. . . Show growing preference** for six-cylinder cars on workhorse jobs. Performance and economy, they say, have improved in the six-cylinder engines. The ratio of cars in oil-field service, however, is still 65-35 in favor of the eight-cylinder cars.

**. . . Are not yet sold** on compact cars in the field.

**. . . Prefer to own** their equipment. About 90% of the firms own their passenger cars and pickups while the others follow a lease-rental plan. One major, however, has found it economical to lease 99% of its fleet.

**New trade-in ideas . . .** The company which has adopted the 4-year, 100,000-mile life for its cars also has dumped overboard two other benchmarks.

In the past, firms believed equipment to have a good resale value should have eight cylinders and automatic transmissions and should be traded at about 2½ years.

This company, however, has put six-cylinder autos with standard shifts in the field; and these models represent 65% of its fleet. Even after 4 years' service, value of the cars for trade-in purposes is still high. By careful study of the used-car market, the company has been able to move its standard-shift models at only $20 to $30 less than those with automatic transmissions.

All the companies find that extensive overhaul and major repairs usually occur in the 50,000 to 60,000-mile range. But by driving the vehicles another 20,000 to 40,000 miles they are able to recover this cost and whittle away the advantage of trading prior to the overhaul period.

Some still hold to the theory of buying extras and trading early. One company reports its equipment life at 40,000 miles or 2 years and a policy of buying eight-cylinder cars with automatic transmissions.

Another is even more conservative: Cars are traded at 30,000 to 40,000 miles, or 19 to 24 months, and most are eight-cylinder, automatic-transmission models.

**The compact story . . .** The American compacts still have not passed the experimental stage as far as oil companies generally are concerned.

All the companies polled have some compacts in service. Most have not adopted them for general use but are testing them in widely scattered areas for durability, economy, and worker reaction.

Only one company gives a green light to the compacts. It is using Corvairs, Falcons, Valiants, and Ramblers extensively, along with the standard models of Chevrolet, Ford, and Plymouth.

Its transportation chief says: "We recently reached a decision that compact cars have sufficient performance, ease of handling, and possible economies to justify extensive use.

"The compacts are better suited for oil-field work than the standard group cars. Driver acceptance has been good, even where monthly mileage has been 4,500 to 5,000 miles. Driver fatigue is minimized because of numerous stops required on majority of jobs."

But most other oil companies are not ready for compacts in general use. Some say fuel economies are not up to expectations and trade-in values are still uncertain. Others see only limited applications for the compact in oil-company transportation.

**Odds and ends . . .** Some other highlights of the survey:

**Average mileage compensation** for workers using their own cars remains at 8 cents.

**. . . Air conditioning** of field cars is still a luxury, although one major allows it in southern areas.

**. . . Seat belts,** favored by safety experts, are standard equipment in only about 40% of the companies polled.

# New Chapter Starts in California Gas Market

• Transwestern pipeline hailed by Los Angeles business men, but another project to build a Mexican-owned supply line touches off opposition.

CALIFORNIA officially welcomed a new supplier of gas to the West Coast last week.

At almost the same moment, still another potential supplier announced it had agreed to build another line from Texas to California within 2 years.

The two events were not directly connected, but they marked another skirmish in the struggle for the vast and growing southern California gas market.

Here's what happened.

**... Transwestern Pipeline Co.** received a plush Chamber of Commerce welcome luncheon.

Transwestern's 1,400-mile line has begun supplying up to 300 million cubic feet of gas daily to Pacific Lighting Gas Supply Co.

**... Tennessee Gas Transmission Co.** and Southern California Edison Co. announced they had reached an agreement on their plan to acquire Texas and Mexican gas and build a Mexican-owned 34-in. line across northern Mexico from Texas to California (OGJ, Aug. 16, p. 96).

Southern California Edison is Pacific Lighting's largest single customer and has received its out-of-state gas heretofore from El Paso Natural Gas Co.'s line from Texas.

**Repercussion . . .** Reaction of Pacific Lighting to the potential loss of its Edison business was swift.

"If such a project as the proposed Mexican pipeline could ultimately be put together, we would have to oppose it on behalf of the 8 million people we serve," F. M. Banks, president of a Pacific Lighting subsidiary (Southern California Gas Co.) said.

Banks made two points:

**... Construction of a line** that would deliver gas to a single industrial customer, such as Edison, would "destroy the balance" in operations of the certificated gas companies.

**... Another pipeline** would give southern California more gas than it needs. The Transwestern line has just been completed, and another project moving gas from Wyoming into California is pending.

Another point made—though not by Banks—was that construction of a line through Mexico would give a foreign country which has a history of expropriation the power to cut off a major source of gas supply for American industry.

**The reply . . .** The question of Mexico's position admittedly is a touchy one in the industry.

As for the possibility that the government would ever deny use of the line to American firms, it would only be punishing itself—losing income which such deliveries would provide.

In Houston, Tennessee Gas explained that while details of the bond sale have not been worked out, the obligation for bond retirement basically will be the Mexican Government's.

"I can't conceive of any reason why they would cut off their revenue from the sale of gas," Senior Vice President William W. Wittmer said.

**The plan . . .** The agreement reached by Tennessee Gas and Southern California Edison follows another agreement reached recently by Tennessee Gas and Pemex covering construction and operation of the 1,200-mile, $165-million line from Reynosa, on the Texas border, to Mexicali, on the California border.

Tennessee Gas is the prime mover in the project. It will obtain gas supply and arrange financing for the line.

However, under present plans Edison will actually buy the gas supplied from Texas and use it for its own industrial purposes. None of the Texas gas would be resold. Although the legal ramifications are not fully known, this method may avoid price regulation by the Federal Power Commission.

The FPC is expected, however, to come into the picture as the President's agent in settling the issue of an export-import license for gas moving into, and out of Mexico.

Parts of the deal also may be subject to approval of the Public Utilities Commission of California.

Edison said that "exploratory conversations" have occurred already with regulatory agencies to determine what types of applications must be filed and what approval is needed to build the international project.

The tentative timetable calls for filing of such applications before the end of the year, their approval by fall of 1961, and construction of the line by July 1, 1962.

**Source of supply . . .** Tennessee Gas has made an important change recently in its plan for obtaining gas for the Mexican line.

The company abandoned an earlier plan for tying in the Mexican line with Tennessee Gas' main line. This would have entailed reversing the flow of certain gas now going north and east and sending it west.

The current plan is to purchase new gas reserves in South Texas for the Mexican line.

Tennessee Gas is keeping the exact source of its gas supply a secret during negotiations with producers and for that reason is not announcing the number of miles of line to be built in the U. S.

More than 75% of the supply for the Mexican line would come from the U. S.

**What's at stake . . .** Under the Tennessee Gas-Edison agreement, the Mexican pipeline would furnish 230 million cubic feet of gas daily at the start. This would build up to 445 million over 5 years.

Edison took an average of 155 million last year from Pacific Lighting. The 5-year contract with Pacific Lighting expires July 1, 1962, target date of the proposed line. Edison would not renew this contract if it can get its own supply.

The movement of this proposed new supply into California not only would take a big slice of business from Pacific Lighting but also would jeopardize another project to move gas into California from Wyoming.

The Public Utilities Commission

## PROCESSING

**Production of acetone** in excess of 100 million pounds per year is the target of newly completed facilities of the Enjay Chemical Co., at the Bayway refinery, Linden, N. J. Enjay, a division of Humble Oil & Refining Co., reports the acetone will be produced through the catalytic dehydrogenation of isopropyl alcohol.

**A research contract** described as the largest ever made by the U. S. Air Force for developing new high-energy liquid propellants has been awarded to Texaco Inc. The $1,300,000 contract calls for studying the entire liquid-propellant program and for development of advanced fuels to solve problems of handling and stor-

**WEST MEETS SOUTHWEST** at Los Angeles Chamber of Commerce welcome for Transwestern Pipeline Co. Robert A. Hornby, left, president of Pacific Lighting Corp., discusses metering with two Transwestern officials, Board Chairman William K. Warren and President Mills Cox.

currently is considering a proposal to move new gas into southern California through lines of El Paso Natural Gas and Colorado Interstate Gas.

Pacific Lighting said that the new Transwestern line and the El Paso-Colorado Interstate tie-in at Rock Springs, Wyo., can deliver ultimately more than 1 billion cubic feet of gas daily—and this should meet southern California needs "for many years to come."

Contracts for the Wyoming project were signed more than 2 years ago, and hearings before the PUC have been concluded.

"This new pipeline will provide substantial quantities of gas at a lower cost than that which could be delivered through the Mexican project, even if consumated," the company said.

**Transwestern . . .** Despite the wrangle over who will furnish future new supplies to southern California, there was genuine joy in the Los Angeles business area last week that the Transwestern project had become a reality.

The lieutenant governors of both California and Texas lauded Transwestern, but it was Transwestern's board chairman, W. K. Warren of Tulsa, who sounded the note that caught the spirit of the appreciation luncheon at the Statler Hilton.

Warren said that when he decided to go into the pipeline business, he never considered building a line to anywhere but California.

"I knew California would be expanding and prospering and progressing toward a goal so vast that even those of us here today can hardly imagine its potential," Warren said.

Hornby cited figures on the growth of California and the gas supply industry—and what's ahead.

Pacific Lighting's subsidiaries have averaged 90,000 new gas meters annually since the close of World War II, and California's population should hit 24 to 26 million persons by 1975.

In 1947 only 57 million cubic feet of gas daily was moving into the Pacific Lighting system from out of state. Today it is receiving 1,400 million, or 80% of its primary gas supply. In the past 13 years the amount of gas supply has increased 17 times, all of it through El Paso's system.

## California Utility To Drill for Gas

PACIFIC LIGHTING CORP., the holding company whose subsidiaries sell gas in southern California, has formed an exploration subsidiary.

The new company, Pacific Natural Gas Exploration Co., will look for gas principally in the Mid-Continent and Rocky Mountains. The firm is jointly owned by Southern Union Gas Co., Dallas.

This is Pacific Lighting's first venture into exploration and first venture outside California.

Southern Union will supply most of the manpower and technical services for the new company. It will own approximately half of any gas and one-fourth of any oil reserves developed.

# BRIEFS . . .

ing high-energy liquids. Most of the research will be handled at Texaco's Beacon, N. Y., laboratories.

**An expansion program** at Sinclair's Gas Products Plant No. 25 near Silsbee, Tex., has increased volume from 35 million cubic feet to 50 million cubic feet daily. The enlarged plant will produce about 105,000 gal. of natural gasoline, propane, butane and other liquefied-petroleum gases daily.

**A Hydeal unit** to produce 15 million gallons of benzene annually is to be built at Plymouth Oil's Republic division refinery in Texas City. Construction is to begin immediately and completion is expected by May 1961.

**Gas liquids production** of the Venice, La., gas plant of Tidewater has been increased from 32,886 gal. to 53,298 gal. daily. Gas capacity was raised from 35 million cubic feet to 55 million cubic feet. Delta Engineering Co. was the contractor.

**A highly refined gasoline** is being introduced by Douglas Oil Co. of California under the name of MPG—Magic Power Gasoline. Company officials say the product contains a new detergent compound that cleans carburetors and keeps them free of gum and deposits, and that tests show a saving of 3% on normal gasoline consumption.

## Also for Refiners . . .

**IN THE NEWS:** Humble and Monterey are engaged in merger talks (p. 101) . . . Russians will get better treatment in their tour of American plants than U. S. delegation got in USSR (p. 102) . . . Joint research project will attack problem of getting a cheap fuel cell for commercial use (p. 104) . . . Sun Oil engineers suggest that refiners can boost octanes materially by reforming a heavy cat-cracked gasoline fraction (p. 112).

**PLUS THESE TECHNICAL REPORTS:** Where to use corrosion probes in petroleum processing (p. 203) . . . Airport features fixed-hydrant fueling (p. 211).

# New Pipe Developments Will Cut Costs

• Aluminum drill pipe, high-pressure tubing joint are described to ASME members as aids to drilling. For the pipeliner: Thin-wall pipe which costs less and weighs less, and a special lined pipe for corrosive service.

OIL industry engineers got a closer look last week at some new equipment designed to lower costs. Some of the items were:

**1. An oilwell tubing joint** said to be resistant to high-pressure leaks but to cost little more than API couplings.

**2. Aluminum drill pipe** weighing only a fraction as much as steel pipe and ready for the market before year's end.

**3. Thin-wall pipe** for oil and gas lines which is cheaper to buy but just as reliable as standard in many uses.

**4. Bimetallic pipe** made of standard steel tubes but containing a lining of more corrosion-resistant metal, thus costing less than tubes made entirely of the corrosion-resistant material.

These new items were discussed in New Orleans where the petroleum-mechanical conference of the American Society of Mechanical Engineers met in its fifteenth annual session.

**Tubing joint . . .** The new low-cost tubing joint is a development of National Tube division of U. S. Steel Corp.

H. Maurice Banta of National Tube said the joint is especially useful in multiple completions where outside diameter of the coupling must be kept small.

Regularly the new coupling has an outside diameter of 2.875 in. when installed on 2⅜-in. tubing. It can be reduced to 2.700 in. for special cases. API external-upset couplings for 2⅜-in. tubing have an outside diameter of 3.063 in.; in special cases, this may be reduced to 2.91 in.

National Tube's joint uses a buttress-thread form and is installed on non-upset pipe. The thread length is relatively long and in the coupling the threads are tin plated for leak resistance. The buttress design results in high joint efficiency for tension. The body of the pipe will pull in two about as quickly as the tubing will part. Average joint efficiency is put at about 98% whether the pipe is J-55, N-80 or P-105.

In compression tests, the body of the tubing consistently buckles before the joint slips or is damaged. Non-upset pipe is used to keep outside diameter low.

In laboratory tests, the buttress thread remains gas-tight through 100 temperature cycles from 60° F. to 200° F. at 15,000 psi. and, Banta said, the company now has more than 1,000,000 ft. of the buttress-jointed tubing in the field and no leak trouble has been reported.

**Aluminum drill pipe . . .** More than 100,000 ft. of hole has been drilled with a partial string of 4-in. aluminum drill pipe, said two other engineers.

Paul E. Brandt and R. W. Flournoy of Reynolds Metals Co., Richmond, Va., said their company put 500 ft. of aluminum drill pipe into the field several years ago.

That 500-ft. section is still in condition for further service, they said. A second string is now being field-tested by a major oil company.

According to Brandt and Flournoy, bending tests of the aluminum drill pipe showed results equal in many respects to steel. The aluminum joints have tapered ends for maximum strength at the couplings. Steel tool joints are used.

The Reynolds men stressed the light weight and corrosion resistance of aluminum. They speculated that success in the current tests might result in commercial marketing of aluminum drill pipe by their company "by the end of this year."

**Thin-wall pipe . . .** Of some 35 oil and gas companies recently contacted, most were using thin-wall pipe. And, their experience with the low-cost tubular material has been good. This is the report of W. P. Heineman, staff engineer for United Gas Pipe Line Co., Shreveport.

Heineman classed as thin-wall pipe any with a wall thickness of 3/16 (0.188) in. or less.

Once, he said, it was common to add wall thickness to a pipeline as protection against external corrosion.

"This is now outmoded," Heineman stated, as external coatings are recommended for all steel pipelines in even mildly corrosive soils.

Internal corrosion can naturally eat through thin-wall pipe faster than through standard pipe, but Heineman said, "extra metal is not the proper precaution." Other known steps can be taken to protect the pipe.

Strength of the light-weight pipe is adequate for many oil field uses, he contended. For instance, a 10¾-in. pipeline made with 3/16-in. walls is at only 55% of its minimum yield strength when holding 1,000 psi. Most consider 72% as maximum allowable.

Strength improves even more as diameter reduces. That is, 4½-in. pipe with 3/16-in. walls is at only 23% of its minimum yield strength when holding 1,000 psi.

Heineman also said thin-wall pipe has as much resistance to collapse as standard thickness tubes.

He cited the case of a 6-in. line laid in 1947 and composed of pipe of only .08-in. walls. The line was coated with coal-tar enamel and ran 35 miles through "a generally corrosive soil." Since completion the line has been in gas service at pressures up to 500 psi. It was cathodically protected in 1955.

No replacements of any kind have been necessary since the line was constructed.

**Bimetallic pipe . . .** Where pressures are high, sizes are large, or alloys are expensive, this pipe saves the most money, Dan Christopher of Gary Tool Co., Houston, reported.

Most effective applications, he said, are those where the lining fully arrests the corrosion or will prevent contamination of product.

Christopher said bimetallic pipe is made by using a thin alloy lining inside of carbon steel. Principal use is in handling corrosive fluids.

Gray makes the bimetallic product, he said, by hydraulically expanding the relatively thin lining of alloy material into a base pipe. In this operation, the lining is stressed into the range of its plastic yield.

Thus, the alloy lining conforms to the exact inside contour of the base pipe. Moreover, Christopher said, the lining adds to over-all strength of the base pipe. Resistance to bending and to internal pressure is higher. Over-all heat conductivity is about midway between that for the lining and that for the base pipe.

Purpose of bimetallic pipe, he said, is to save money by substituting a

low-priced base metal (carbon steel) for high-priced alloy. A wide range of alloys may be used. Most popular are the alloys of copper and nickel.

Experimental work is now being carried out with titanium, tantalum, and zirconium. Each, Christopher revealed, has "considerable promise for future needs."

He said bimetallic pipe might be economically used:

... **Where corrosion** can be fully or essentially controlled by a thin layer of corrosion-resistant materials.

... **Where lining** may be used to prevent pickup of corrosion contamination by the product more cheaply than the contamination can be removed downstream.

... **Where a dual corrosive** atmosphere exists for which no one material is suited.

... **When a catalyst** is poisoned by ordinary materials and the bimetallic pipe might be either a support for the catalyst or a vessel to speed up reaction.

... **Where more** structure strength is needed than can be withstood by the alloy material.

## Socal Consolidates

### . . . activities of five subsidiary operations.

STANDARD OIL CO. of California is building a little flexibility into its operations.

A new company named California Oil Co. is being organized to direct operations now carried out by five subsidiaries operating east of Socal's western operations.

Generally the consolidation is patterned after the consolidation of subsidiaries of Standard Oil Co. (N. J.). The Socal subsidiaries will operate as divisions of the new company rather than as separate corporations.

The five companies affected are: The California Co., operating on the Gulf Coast, in the Rocky Mountains, and in southeastern states; Standard Oil Co. of Texas, which is limited to operating in Texas and New Mexico; Salt Lake Refining Co.; Pasotex Petroleum Co., which operates in Oklahoma; and the California Oil Co., the East Coast refining and marketing company.

About the only change planned at this time is moving the Utah and southeastern Idaho marketing areas under jurisdiction of the new company. This area currently is handled by Standard Oil Co. of California's Western Operations, Inc.

The consolidation is scheduled to become effective January 1.

## watching WASHINGTON

Clyde La Motte

### • Rate-of-return rulings distress gas pipeliners . . .

INTERSTATE GAS pipeline firms are becoming increasingly alarmed over the pattern of rates of return the Federal Power Commission has been setting lately.

To the transmission firms, the rates seem entirely too low. The net result, as they see it, will be the drying up of investment capital which the lines must have if they are to continue their expansion programs.

Several firms, including Tennessee Gas Transmission Co., have objected strenuously to the rate of return granted them on projects recently approved by the FPC.

Last week the Independent Natural Gas Association of America joined the rising chorus with a strongly worded letter to the FPC.

This was an unusual move by the organization, which normally stays in the background in such matters and which never intercedes in individual cases before the FPC.

In this instance, however, the association apparently felt there had been enough FPC decisions on this point to establish a new pattern for setting rates of return. And this pattern caused the INGAA concern.

In its letter to the FPC, INGAA pointed out that in past years the commission allowed pipelines to earn over-all rates of return on common equity "sufficient to cover not only the interest cost of their long-term debt and dividends on their preferred stock, but also to provide a return on common equity sufficient to assure their financial integrity." This, INGAA said, enabled the pipelines to maintain their credit and to attract capital with which to expand facilities to meet ever-increasing demands for natural gas.

INGAA noted that, for the most part, adequate earnings on common equity were possible under a 6% over-all rate of return. This was possible, association officials said, because of the low historical cost of long-term debt capital.

### • Who should pay higher debt costs? . . .

THE TROUBLE NOW, INGAA told the FPC, is that during the past several years the cost of long-term debt has risen "very substantially."

Facing these higher debt costs, a pipeline firm seemingly had only two choices: It could drop expansion plans, thereby eliminating the need for attracting new capital, or it could seek a higher rate of return necessary to attract the required flow of investment funds.

In trying to follow the second course, however, pipeline firms ran into decisions which whittled away at the rate of return.

INGAA maintains that this "new" policy by the FPC simply means that the stockholder is the one who gets saddled with the higher cost of long-term debt capital because the greater costs cut deeper and deeper into his earnings.

"The squeeze on the industry's thousands of common stockholders, resulting from this policy, has the same effect on the stockholders as if the commission were to disallow some portion of necessary and legitimate operating expenses," INGAA said in its letter to the FPC.

### • Industry view: FPC staff carries too much weight . . .

THERE APPEARS to be a general feeling in the gas-pipeline industry that the basic factor in the rate-of-return issue is the attitude of the FPC staff.

The staff, feeling it must keep consumer prices as low as possible, has sought to convince the commission to keep the lid on rates of return.

Thus INGAA aimed its letter at the commissioners themselves, obviously hoping to offset the staff's influence.

There is little doubt that the pipeline companies are going to continue to use every approach possible to persuade the FPC to loosen up on the rate of return.

# Who'll Get Squeezed in East Texas?

**• Atlantic-Tidewater plan to save millions by shutting in unneeded wells draws strong opposition. It will hurt the economy of the region, Railroad Commission is told by business men. At issue: The commission's authority.**

SEVERAL HUNDRED East Texas businessmen, mostly from Kilgore, homed in on Austin September 20 to apply pressure against Texas Railroad Commission approval of allowable-transfer proposals of two major operators in the huge East Texas field.

The proposals, filed by Atlantic Refining Co. and Tidewater Oil Co., would permit operators to shut in several thousand East Texas field wells and produce their allowables through remaining producers as a cost-cutting measure (OGJ, Aug. 22, p. 44).

The plans would not raise or lower present field production or allowables, neither would they affect royalty payments, taxes, or the allowable status of the big pool's roughly 3,100 marginal or nonprorated wells.

Opposition of the area's business, reportedly whipped up by oil well servicing contractors, was based on their fears that the region's economy would be hurt through loss of employment and lower income from oil equipment sales and services.

**Operating costs knifed . . .** Atlantic's plan would shut in seven of eight wells, with the permissive allowable-transfer distance restricted to a radius of 950 ft. from the well designated as the producer.

If applied field-wide, it would reduce the number of producing wells in the field to about 8,300, where now there are 19,250 prorated and marginal wells in the field.

The Tidewater plan basically calls for closing in two of each three wells.

The proposals stem from a situation wherein allowables for most prorated East Texas field wells, including the most prolific in the "fairway" portion of the big field, have sunk to a measly 6-bbl. daily average. Many of these wells, the companies report, still could easily produce several thousand barrels daily each. And, the 6-bbl. daily or 160-bbl. monthly average is not greatly in excess of the economic limit. The companies argue that in contrast some of the poorest wells in the field, the marginal wells, are permitted to produce up to 20 bbl. daily or 600 bbl. a month.

The proposed allowable-transfer rules, Atlantic contended at the hearing last week, would save operators in the field an estimated $22,000,000 in operating costs alone in the 1960's.

This estimate is based, it said, on an operating cost of $20 per well each month—and with no allowance for overhead or management. Savings would total $70,000,000 or more over the next 50 years, Atlantic contended.

**Agency authority questioned . . .** The opposition, which motored to Austin in a fleet of automobiles and chartered buses, fought the proposals on grounds that "the commission cannot consider such a petition on the sole basis of the companies' economics."

The applicants, they argued, could not show that their proposals would result in the recovery of one barrel of added oil from the field.

Atlantic and Tidewater contended this argument had no legal foundation. "No court," Atlantic's D. W. Stayton declared, "has ever held that this commission can't consider economics. You issue orders every day on the basis of economics. If the orders we propose do not decrease production, the duty rests on the commission to let us save the money."

Surveys of East Texas producers have indicated that the field operators generally approve the idea. Major company support, though not active, has been solid. Independent operators, too, mostly favor the intent and purpose, though some condition their approval to assurance that allowable transfers will be strictly administered and the volume restricted to a total not exceeding the marginal allowable.

Atlantic and Tidewater carefully pointed out at the hearing that their plans only called for shutting in wells—not abandoning them. The shut-in East Texas producers could quickly be put back to work in case of emergency, special field developments, or in case the demand for field oil should increase greatly for any other reason.

John Cameron, Tidewater engineer, pointed out to the commission that it already is permitting transfers of allowables of prorated wells in the field. There are at least four field rules permitting transfers under various sets of conditions.

# PIPELINE BRIEFS . . .

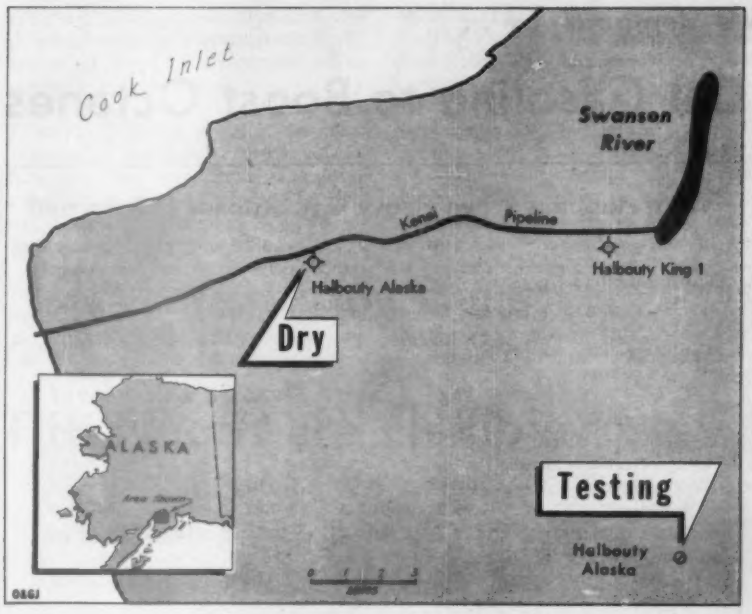
**Shamrock Oil & Gas Corp.** is replacing 25 miles of 6-in. crude line between its Clawson station in Hansford County and the Farnsworth area in Ochiltree County, Texas, with an 8-in. line. H. A. McGinnis is the contractor.

**Western Slope Gas Co.** plans to build a 22-mile, 4-in. gathering line to connect Powell Park field with the Piceance Creek compressor station. It also plans a 6-mile, 4-in. system to connect Union gas wells with Rifle, Colo. Western Slope has added a field compressor at North Douglas Creek and plans another 170-hp. unit in Continental Douglas field.

**Objecting railroads** will have to wait awhile before reducing rates to meet Mid-America Pipeline competition on LPG shipments from the Texas-New Mexico area to the Midwest. The reduction takes effect automatically in 7 months unless the ICC approves a rate cut in the meantime. The railroads, principally Texas-New Mexico Railway and Texas Pacific Railroad, sought a cut of 10 cents per barrel until they could work out new rates based on 20,000 to 30,000-gal. tank cars. Katy, part owner of Mid-America, opposed the cut and was sustained by ICC pending an investigation.

**Canadian pipeline deliveries** totaled 23,884,251 bbl. in June, slightly less than the June 1959 figure of 24,087,457 bbl. and 8.6% under the 26,140,272 bbl. delivered in May 1960. For the year to date, however, deliveries were 162,261,152 bbl., up 5.1% from the first 6 months of 1959.

**A main-line looping** program has been inaugurated by Peoples Gulf Coast Natural Gas Pipeline Co. The program, involving 371 miles of 30-in. line, is divided into six schedules: Two in Texas, 97.6 miles; two in Arkansas, 135.1 miles; and one each in Mis-




# Second Halbouty Test Is Dry

HALBOUTY ALASKA Oil Co. has abandoned its second Kenai Peninsula wildcat in Alaska but is testing the third for gas.

Hard luck has dogged Halbouty's exploration efforts in the 49th state. The first wildcat on Kenai, just west of Swanson River field, was a duster.

Last week Halbouty said its Bishop Creek unit 11-11, 9 miles west of the Swanson River field, has been plugged at 9,034 ft. It had no shows of either oil or gas. The third well shows some promise, although it was a disappointment at lower depths. It drilled to 14,019 ft.

# Expansion Planned

## . . . by Texas Eastern to increase system capacity.

TEXAS EASTERN Transmission Corp. is preparing to expand its system capacity by 150 million cubic feet daily at a cost of $70 million.

The new expansion, announced last week, is in addition to another 50-million-cubic-foot expansion currently awaiting FPC approval.

The latest project contemplates taking gas from North Louisiana and building a new line that ties in with the company's main 30-in. line at Kosciusko, Miss.

The remainder of the new capacity would be provided by looping the main line.

Texas Eastern plans to add the 150-million capacity in two increments—half in 1961 and half in 1962.

Texas Eastern hopes that the proposal currently before FPC for a 50-million-cubic-foot expansion will be approved in time to make this additional capacity available during the 1960-61 winter-heating season. The project would cost $17 million.

Announcement of the expansion came from James W. Hargrove, financial vice president, who spoke before the Cleveland Society of Security Analysts. Hargrove told the analysts that Texas Eastern expects to earn $2.45 per share on common stock this year.

souri, 81.9 miles, and Illinois, 56.6 miles. All are scheduled for completion by December 21. The company is also adding 58.8 miles of gathering lines in Brazoria, Galveston, Aransas, and Refugio counties, Texas.

**During hurricane Donna,** the Houston (Tex.) Gas and Oil Corp.'s natural-gas line between Texas and Miami functioned without interruption. Portions of the line were in the path of the storm, which did considerable damage to other forms of transportation.

**A crude-oil** pipeline is being built by Ashland Oil & Transportation Co. from Zachariah to Campton, Ky. Cumberland Contracting Co. is the contractor for the 10-mile, 6-in. line, due for completion November 1.

**FPC permission** is being sought by Panhandle Eastern Pipe Line Co. for construction of 150 miles of 24-in. and 50 miles of 20-in. line to connect the Elk City, Okla., field with its Haven, Kans., station. Six Elk City producers would supply 125 million cu. ft. per day. The line would cost $15,700,000.

**The 69 major** oil-pipeline companies handled 1,166 million barrels of crude and products in the second quarter of this year against 1,143 million barrels in the same period of 1959. Their gross revenue was up 1.3%, from $174 million a year ago to $176 million this year.

**Yellowstone Pipe Line Co.** will complete an 82-mile, 6-in. products pipeline from Helena to Great Falls, Mont., by late November. A new 1,000-hp. pump station has been added at Springdale and another of 500 hp. is planned for Helena. R. H. Fulton & Co. is the contractor.

**Supplies of 16-in.** line pipe are building up rapidly at a staging area at Badulipar, India, in preparation for construction work on a 260-mile crude carrying system from the Nahorkatiya area to Nunmati. Spreads will start moving in October after the monsoon season ends. A 460-mile 14-in. extension to Barauni will be added later by Oil India Ltd., owned two-thirds by Burmah Oil Co. and one-third by the government.

## *Also for Pipeliners . . .*

**IN THE NEWS:** California welcomes Transwestern pipeline but opposition arises to another project to import Mexican gas (p. 106) . . . New pipe developments should result in cutting costs (p. 108) . . . Texas Eastern Transmission plans expansion project (p. 111) . . . Mid-America proposes Superior-Chicago line to move Alberta condensate into Chicago refining market (p. 116) . . . Algerian crude pipeline ready for operation (p. 121).

**PLUS** the monthly pipeline construction report (p. 228).

***You can meet tomorrow's demands by . . .***

# . . . Reforming Cat Gasoline to Boost Octanes

TOMORROW'S HIGH octanes can, in many cases, be obtained by today's units.

The processing route: Reform a heavy catalytically cracked gasoline fraction that is rich in naphthenes. By choosing the heavier cut, a majority of the olefins are weeded out of the reformer charge and it will produce a higher octane gasoline.

These results are outlined by a team of Sun Oil Co. engineers—R. F. Kress, H. W. Nagel, and H. E. Reif—in a paper being presented this week to a national meeting of the American Institute of Chemical Engineers in Tulsa.

Sun points out that current trends show that leaded research octane number will increase to about 105 during the coming decade, and that the average refiner is short of gasoline streams that can meet this specification. One way to scale this octane height, Sun said, is to reform the heavier end of gasoline from the cat cracker.

Outlining the results of its pilot-plant study on this method, Sun said:

. . . **Reforming selected** cuts at moderate severity produces $C_5$+ reformates having leaded research octane numbers up to 107.4 at 90 vol. % recovery.

. . . **These reformates** show a blending octane number of about 106 with a sensitivity of about 5.5, when blended at 25 vol. % concentration in a 105-leaded research octane base fuel.

. . . **Processing costs** would be less than 2 cents per gallon if spare reformer capacity is available. This figure includes changes in refinery yield structure.

. . . **These costs** will increase to about 4 cents per gallon if virgin naphtha must be backed out in order to make room for the heavy catalytic gasoline.

Pointing out why additional processing will be needed in the next few years, Sun cited the case of an average refiner:

Alkylate is generally the largest stream available today with a leaded octane number above 100. Although many refiners have other streams, such as polymer gasoline, toluene, or aromatic concentrate, these streams form a small part of the gasoline pool.

Since he must also meet volatility and hydrocarbon-type requirements which are met by adding low-octane components to the final fuel blend, the refiner is going to have to find some other means of increasing the octane number of his gasoline pool.

Noting that gasolines from the cat cracker generally are rich in naphthenes, Sun engineers undertook a pilot-plant study to determine what effect reforming would have on those fractions boiling above 235° F.

They reason this way: The presence of olefins in a reformer is undesirable because they lower the octane of the reformate. Analysis of cat-cracked gasoline shows that the majority of the olefins are in the low-boiling front end. Therefore, by selecting a heavy gasoline fraction from this material, most of the olefins are eliminated.

**Experimental setup** . . . The reformer was a three-reactor adiabatic pilot plant employing a commercial platinum-on-alumina catalyst. Moderate reforming conditions were used with a reactor-inlet temperature of 925° F. No catalyst-life tests were run, but the cracked gasoline appeared to have no adverse effect on the catalyst.

Although the gasoline fractions were not hydrotreated prior to reforming in this pilot-plant study, Sun said that, in practice, this would be desirable. Hydrogen treating of the cat-cracker gasoline charge to the reformer not only would remove sulfur compounds, but also would saturate the olefins present.

**Results** . . . Product yields and octane numbers obtained on reforming each cut are shown in the table.

## What Happens When Heavy Cat Gasoline Is Reformed

| Cut number— | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Fraction boiling range, °F. | 235-270 | 270-300 | 300-340 | 340-412 | 235-412 |
| Product yields, vol. % of charge | | | | | |
| $C_5$+ | 86.6 | 90.8 | 92.0 | 90.8 | 91.9 |
| $C_4$'s and $C_3$'s | 11.1 | 7.5 | 6.3 | 6.6 | 6.2 |
| $C_5$+ reformate octane numbers | | | | | |
| F-1 clear | 99.7 | 103.5 | 104.5 | 101.7 | 101.0 |
| F-1 + 3 cc. TEL | 104.2 | 106.8 | 107.4 | 103.6 | 104.6 |
| Sensitivity (+ 3 cc. TEL) | 9.9 | 9.5 | 8.6 | 9.9 | 10.2 |
| **Octane number gained by reforming (F-1 + 3 cc. TEL)** | **+13.3** | **+11.4** | **+9.5** | **+17.2** | **+12.3** |

The catalytically cracked gasoline with which this reformate is compared was obtained from a commercial cracking unit which charges fresh gas oil from a low-sulfur Gulf Coast crude mix.

By comparing the properties of each charge fraction and the resulting product properties, Sun's engineers pointed out which of the fractions showed the greatest promise.

. . . **Cut 1** had the best TEL susceptibility, but it had the lowest leaded octane number.

. . . **Cuts 2 and 3** showed the greatest promise, Sun said, because the $C_8$ and $C_9$ aromatics found in these cuts produce gasolines, both before and after reforming, that are the highest in octane number of all the cuts.

By combining cuts 2 and 3, the 270°-340° F. fraction represents about 15 to 20 vol. % of the total catalytic gasoline, Sun said, and, under the moderate reforming conditions used, a yield of $C_5$+ reformate of about 90 vol. % could be expected.

. . . **Cut 4** would be an undesirable component in premium gasoline because of its higher $C_{10}$+ aromatic content and its consequent lower octane number.

. . . **Cut 5,** which is a composite of the first four cuts, shows the combination of the effects of relatively high paraffin content and heavy aromatics. It, too, has a lower octane number than the more desirable cuts.

However, the octane number of all cuts could be increased by boosting

reformer severity, Sun explained, but it would result in a corresponding decrease in the $C_5+$ reformate which could be recovered.

**Costs . . .** Although an exact estimate depends on the specific case involved, Sun said that the cost of upgrading cat-cracker gasoline would be less than 2 cents per gallon if spare reformer capacity is available.

If capacity is filled with normal reformer charge, however, it would be necessary to back out enough virgin naphtha to make room for the cat gasoline. The backed-out virgin material could then be thermally cracked to add to the regular gasoline pool if the TEL level allows. If this were the case, Sun figured the cost of processing would be boosted to about 4 cents a gallon.

There's one other angle to consider, too. The fuel market will expand within the next 10 years and with it will come an increase in crude runs. In this case, Sun said, it would be more logical to build a reformer specifically designed to accommodate heavy cracked gasoline. Cost of upgrading these gasolines then would be a function of each refiner's needs.

# Fire Floods are Flexible

## . . . Sinclair's Leonard Emery tells API. They'll sweep 75% of oil in place, will work in light-oil fields, too.

THERMAL recovery is a more valuable tool than most people consider it.

Some virtues not generally recognized:

**. . . It can recover** as much as 75% of oil in place in addition to that used for combustion.

**. . . Fracturing** is no barrier to use of the technique, despite some earlier fears.

**. . . Most producing formations**—not just those with viscous crudes—lend themselves to fire flooding.

**. . . It is "just as effective"** as, and is economically competitive with, water flooding and miscible-phase techniques.

This report on knowledge gained from research into thermal recovery came from Leonard E. Emery, Tulsa engineer with Sinclair Research Laboratories, Inc. He addressed the Tulsa section of the API's standing subcommittee on secondary-recovery and pressure-maintenance methods. Emery is engineer on Sinclair's Humboldt, Kan., field experiment with thermal recovery.

Perfection of thermal-recovery techniques will make more valuable the old oil reservoirs partially depleted by primary and other secondary-recovery methods. In fact, many marginal areas of production already are being evaluated to determine if fire flooding is practicable.

The basic steps in a fire flood are simple.

Heat is generated in an injection well until a large block of heat is created. Combustion is then transferred from the injection well bore to the formation. The combustion front is then moved through the reservoir with a gas containing oxygen. This moving heat front pushes the oil ahead of it into the producing wells.

**New igniter . . .** Sinclair has developed an air-gas burner which has a big advantage of being able to generate large quantities of heat in a short period.

In a well with only 10 ft. of sand, 300,000 B.t.u. per hour can be generated safely. This is far beyond the capabilities of a down-hole 10-ft. electrical heater, Emery said.

Sinclair's start-up method also is unusual. Pellets of calcium phosphide are lubricated into the well and allowed to drop to the 3-ft. tubular burner at the top of the producing formation. These are followed by a small quantity of water—a pint is sufficient. When water contacts the pellets, phosphene gas is formed, and this ignites spontaneously in the presence of oxygen.

The heat wave has been started in injection wells with casing sizes varying from 2-in. to 6⅝-in. Emery also reported that open-hole completions, casing set through and perforated, and perforated liners hung in the casing, all have been tested for fire flooding with good results.

**Sustained heat front . . .** After combustion has been transferred to the producing formation, the operation requires little more attention than is necessary in a conventional gas-injection or water-flood project.

Emery said actual tests show that effects of thermal sweeps are evident in temperatures of produced crudes 2 months after burning processes have been stopped. Continuous fire flooding has been operated successfully up to 5 years at the Kansas testing grounds.

Producing wells can either be pumped or allowed to flow. The high gas-oil ratios associated with use of the thermal processes make flowing possible in most cases.

**Water no problem . . .** "There is some concern," Emery told the committee, "over oil and water emulsions produced by the thermal-recovery process.

"However, typical production-curves from our tests show that for a well with a 2-year producing life, measurable quantities of water were produced only during the last 2 months. On this basis, it is expected that treating problems will not occur until late in the life of any thermal project."

Emery said portland cement or mixtures of portland and pozzolanic materials used in cementing casing usually are adequate. He emphasized a good primary cement job is essential.

Corrosion of well equipment and surface piping is no more a problem with the thermal systems than in other types of recovery work, Emery said.

# Helis Reelected

## . . . chairman of Louisiana State Mineral Board.

WILLIAM G. Helis, Jr., New Orleans independent oil operator, will serve another term as chairman of the Louisiana State Mineral Board.

Gov. Jimmie H. Davis renamed Helis last week to the board. The board, in turn, reelected him chairman. The board controls leasing of state lands and offshore acreage for oil and gas development.

Gov. Davis also reappointed four other members of the old board and appointed 10 new ones. The holdover members had served during the Earl K. Long administration. Those who will serve again are Helis, Gordon Collins, Shreveport; Mayo Iles, Clarks; Sam Mancusco, Lake Charles; and Gordon M. Le Blanc, Shreveport.

New members are Hal S. Phillips and Don B. Hearin, Jr., both of Baton Rouge; A. M. Stall and H. Lloyd Hawkins, both of New Orleans; C. H. Henry Masters, Sr., and Chester J. Coco, both of Marksville; Armand J. Petit, Cut Off; Sam Caroline, Berwick; Dr. Paul Azar, Lafayette; and G. H. Jett, Shreveport.

Reappointment of Helis to the board came as no surprise. Helis had been an active supporter of Davis during his campaign for governor, and he has had the general support of the industry during his tenure as chairman.

C. J. Bonnecarrere, secretary to the board, will continue as operating director of the board's activities.

"... Stress can be positive ..."

# JOB TENSION—

**STRESS isn't always a problem. Used intelligently, it can be a vital force in the development of creativity and determination. This is true in the oil industry, as in every field where enterprise counts. The author tells how a company can put tensions to work and what can be done to prevent "stress illnesses."**

**BY DR. RICHARD CALL**
Medical Director, Union Oil Co. of California

IN OIL'S highly competitive, dynamic atmosphere today, there is much discussion of stress as it affects oil workers—their health, their family life, and their jobs.

There is increasing sympathy for workers who contend with automation and competition within the petroleum industry, international tensions and "adversity" of every type.

The impression is left that the force of stress, growing out of these circumstances, is a new and dreaded one. Some suggest this force jeopardizes health and happiness. Others say government or the industry itself must intervene to protect the individual through this "fearful" period. In fact, to be labeled as a victim of stress is distinguishing—a badge of honor.

Such nonsense leads to individual and national self-pity, ever-increasing abdication of individual responsibility, and sanctimonious excuses for social misbehavior.

**Tensions beneficial? . . .** Stress exists in all of our lives today.

It existed in the past and it will exist in the future. Fortunately, no social planner attempting to create a more "beautiful" tomorrow can legislate it out. Always present in each of us in varying degrees, stress can serve as a positive and constructive force for more self-respect, reliance, and achievement.

Without it, productivity slows, progress is unthinkable, and individual determination among thousands of oil workers is lost.

Undoubtedly, much discussion concerning stress in the oil business arises because only recently has it been clearly recognized and partially defined as a vital force. Its significance has been exaggerated and abused.

It should not be treated as a new, fashionable toy, nor its recognition used as an excuse for greater individual adbication of responsibility.

Stress can be produced primarily from forces within as well as those from without. Any man or woman in the oil industry, regardless of age or position, has several basically strong needs. There is the need for financial security; the need for tangible recognition within the organization in the form of promotions, awards, and praise; and the need for acceptance by fellow workers.

These three factors exist in everyone. If one or more is denied or threatened, the worker goes through a stressful period.

All of us know individuals whose aggressive drive for recognition is greater than the company's willingness to promote and advance. There are others whose passive personality or domineering attitude makes them unacceptable to their associates. These people suffer some stress, depending on the intensity of their drives and their lack of ability to reconcile them with everyday realities of the oil business and industrial life.

**Stress is old stuff . . .** There is not one shred of evidence that these basic drives of security, recognition, and acceptance are any more intense or difficult to satisfy today than 50, 100, or even 500 years ago. Human nature does not change. These drives are age-old factors.

Their satisfaction may even appear easier to achieve now. With the growth and maturing of the oil industry, the opportunity for security—always relative at best—would appear greater today.

The broad expansions in the petroleum business give the oil worker more, not less, opportunity for faster recognition and promotion. Too, with the increasing tolerance and wider understanding of human nature today, he has more chance of acceptance within a group.

"... don't treat it as a toy ..."

"... some need a stimulus ..."

"... the rewards are obvious ..."

# The Tool We've Buried Under Myths

The clamor arises from some that the oil business is much larger and more complex than before and, consequently, its employes are under more stress and strain. Once again, we may be indulging in a little self-pity—all too ready to accept any excuse that our times and problems are just a little bit more difficult than before.

Some oil companies emphasize quality and others tie in quality and quantity, but all are determined on eventual profit. This is the true hallmark of success. Some claim that in achieving such success, life is more difficult and therefore more stressful. But is it?

On the lower levels in oil companies, far better working conditions, shorter hours, and more pay has eased the threat of severe economic depression, many diseases, and long, tedious hours in the field or on the rig floor.

The keen stress of just plain survival has been largely blunted. Now, thousands of employes have additional hours for recreation and leisure.

**Executiveship easier? . . .** For management, just how much more stressful are the size and complexities of current problems?

As always, decisions must be made, responsibility delegated, and performance demanded. There's nothing new in this. And to meet the demands of this technological age, the industry is supplied with an army of well-trained specialists, equipped to meet these advances.

The modern oil executive may have to be versed in more subjects than his predecessor, but he also has much more knowledgable assistance to call upon.

His age-old responsibilities of decision and delegation remain largely unchanged. How many would trade the anxieties of the recession of 1949 and 1958 with the catastrophic depressions of the years following the Civil War?

There is a question of whether the oil industry should use stress among its employes. A certain aura of fear has developed around the term and its implications. To publicly advocate its use is largely unacceptable.

Yet, when properly used, it is extremely effective.

**Pressure pays off . . .** Stress must be used intelligently and with purpose.

It has within it the capabilities of developing creativity and excellence, and when improperly used it can cause chaos and waste.

Oil has learned to control and respect basic elements, and an employe's basic reaction to stress also may be diverted to a useful and constructive purpose.

The petroleum industry should not hesitate to use stress in demanding higher levels of achievement, greater perfection of work performance, and higher productivity.

In any business organization, there are individuals whose basic inner drives are so powerful as to require little or no extra stimulus. The great majority who are not so favored do require a stimulus in order to work at near capacity, both in a quantitative and qualitative sense.

The rewards of stress to industry are direct and obvious, but not to be minimized are the benefits to the individual.

Superior work performance, publicly recognized, is still a deeply satisfying experience. Technological advances of this decade cannot and should not be allowed to change this.

**Stress is misused . . .** The capabilities of stress have been abused and misused. The result invariably has been defeat and frustration.

Even in this mechanical age, capable employes still are a valuable commodity—and in many ways far more difficult and costly to replace than the machines they command.

It is to management's advantage to use stress with care and consideration, and to avoid its excesses. Dangerously poor working conditions, unreasonable demands, impossible goals, and unfair, arbitrary decisions put unnecessary tension on employes which eventually destroy their effectiveness.

Prolonged, excessive stress can cause both physical and mental illness. Because this can be identified today does not imply it is a new phenomena. Such an identification does permit us to use this historical tool more effectively and intelligently with some chance of avoiding excesses.

Physicians continue to treat individuals suffering from so-called "stress diseases," such as peptic ulcers, high blood pressure, and mental breakdowns. Everyone, without exception, has a breaking point and, given a sufficient amount of stress over a period, eventually would show some physical or mental stigma.

**Fixing the blame . . .** It has become commonplace to attribute these "stress

diseases" largely to a man's job and his responsibilities. To blame the oil industry and other industries is socially acceptable, because the industry is large and impersonal with little chance for effective defense or justification.

It puts the afflicted employe in the respected position of making a major sacrifice toward satisfying a hard taskmaster. Unquestionably, certain employes react to the tensions of good job performance so excessively that illness develops. But, before that is accepted as an all-inclusive indictment, it should be realized that many stress illnesses have their roots in circumstances far removed from the job.

These could be difficult family relationships, financial obligations, and unusual personality traits. No one major factor ever should be singled out as a whipping boy.

Some say we can be saved from this terrible emotional ordeal only by government direction and assistance. This is ludicrous. It is inconceivable, if not laughable, to imagine such an impersonal, huge, and ponderous institution as the government being of any direct assistance with this problem.

Another frequent recourse is the almost compulsive use of tranquilizers. Approximately $250,000,000 worth of these little panaceas were consumed last year. These drugs have an important part in medicine and are extremely useful in seriously disturbed people.

But, for most workers in the petroleum industry, they answer few questions and solve no problems.

**The remedy . . .** The most important point in dealing with stress is to keep its significance in proper focus—to accept its presence as beneficial, to beware of its excesses, and reject its overimportance and exaggeration.

Fortunately, with a minimum of difficulty, and no real sacrifice, certain personal habits can be acquired that can effectively protect most of us.

Adequate rest, taken in properly measured degrees, offers great protection. It creates the right emotional climate and stability to withstand the normal and beneficial tensions necessary to accomplish and to compete.

**Diversify and relax . . .** Another defense mechanism which can be built into an oil employe's life is diversification. To complete a tense, hard day's work is not only frequently necessary, but completely self-satisfying and rewarding.

But, to allow stresses of the job to become all-consuming and ever-present throughout the entire week is not only unproductive, but usually a destructive attitude. Diversification of interests into other fields is enjoyable, and protective.

It can be a sport, hobby, or community activity, provided that it marks a complete break with any possible association with one's job as engineer, supervisor, tool pusher, department head, or manager.

**Cheap and sure . . .** These mechanisms—understanding, adequate rest, and diversification are simple and highly effective.

Not as financially demanding as expensive tranquilizers, as comfortable as a psychiatrist's couch, nor as sympathy-promoting as a "stress disease," their accessibility is within the reach of every worker. Their effectiveness is steady and sure.

Unfortunately, stress is being suggested as a new and terrifying factor in the petroleum industry—in industrial America. This is neither fair nor accurate. It is simply that we have an awakening appreciation of its importance both in a positive and negative sense.

It is regrettable that some would seek to capitalize on its destructive attributes, for its very nature lends it so much value. As a greater understanding of its potential grows, and its wiser use develops, the petroleum industry will find stress one of its most useful tools.

# Chicago-Superior Link Urged

## . . . by Mid-America as the cheapest way to create pipeline grid to move Alberta condensate into Chicago markets.

A $21-MILLION pipeline project which would allow condensate from Alberta to move into the Chicago refining area is being proposed by Mid-America Pipe Line Co.

President Robert E. Thomas of Mid-America plans a 405-mile, 10-in. line from Superior, Wis., to Chicago.

The line would connect at Superior with the trunk line of Lakehead Pipe Line Co., the eastern division of Interprovincial Pipe Line Co.

Shipments would be fed into Interprovincial from gathering lines in Alberta now under consideration before the Alberta Oil and Gas Conservation Board at Calgary.

The Superior-Chicago line would be built and operated by Mid-America or a subsidiary. Initial daily capacity with three pump stations would be 26,000 bbl. Capacity could be stepped up to 55,000 bbl. daily by adding three more stations.

Thomas said studies indicate that the Alberta market will consume most of the propane produced there. Butanes and condensate, however, must find an export market; and Chicago refineries appear the most logical outlet (OGJ, July 18, p. 57).

**Moves ahead . . .** Several steps must be taken before the project can be finally cleared and construction dates set.

Mid-America officials must:

**. . . Win an export permit** from the Alberta board.

**. . . Win an export permit** from dominion authorities at Ottawa to take products out of the country.

**. . . Arrange import quota** timetables from the imports-control program of the U. S.

**. . . Complete arrangements** with shippers to use the proposed pipeline system.

Because of delays inevitable in this much dealing with governmental agencies, prospects are that the line could not be started before 1962.

Mid-America's proposal has the advantage of requiring a much lower investment than other proposals to move Alberta condensate into Chicago. Foothills Pipe Lines, Ltd., affiliated with Westalta Products Pipe Line Ltd., and backed by Pembina Pipe Line Ltd., has proposed a 1,300-mile, 16-in. trunk line for the same purpose. It would run from the Alberta-Saskatchewan border to Chicago.

Mid-America's lower-cost proposal thus may have a significant bearing on the current Calgary hearings on proposals for gathering systems in Alberta. Thomas said that Mid-America at the hearings will support the applications of Hydrocarbons Pipeline, Ltd., and Provincial Pipeline, Ltd., both of Calgary. These two propose to gather condensates and move them into the Interprovincial system to which Mid-America would be linked.

A third proposal for a gathering system in Alberta has been made by Westalta Products. Some Canadian oil men predict the conservation board may suggest the three competitors agree to join in creating a "grid" gathering system for products. This would be similar to formation of Alberta Gas Trunk Line Co., Ltd., which provides a grid for exporting gas from the province.

Mid-America also is constructing a large products pipeline system stretching from the Texas-New Mexico border to Milwaukee and Minneapolis.

**SOUNDPROOFED** drilling rig doesn't bother golfers at Los Angeles' Hillcrest Country Club.

# Record Town-Lot Drilling Approved

**• Signal and Richfield add 1,506 acres to their West Los Angeles drilling play as the city approves 11 new drilling districts. This means further development of one of the city's best town-lot fields.**

THE BIGGEST bundle of town-lot leases ever presented to the Los Angeles City Council for conversion to drilling districts won approval last week.

The leases cover 1,506 acres in West Los Angeles where Signal Oil & Gas Co. and Richfield Oil Corp. have developed 4,500-bbl. daily production in drilling from two golf courses. Eleven separate drilling districts, covering about 7,500 town lots, were involved in the council action.

Approval of the districts gives Signal and Richfield drilling rights on approximately 1,920 acres. The companies hold leases on 5,100 acres in this area, but the drilling districts cover only 1,920 acres.

The Signal-Richfield acreage is one of the largest drilling areas in Los Angeles' town-lot play. The only area of comparable size is immediately to the east, where Signal and Union Oil Co. hold leases on 7,000 acres. About 2,000 acres of the Signal-Union land is covered with drilling permits.

The new districts of Signal and Richfield are in the heart of the West Los Angeles drilling play, by far the city's most promising. Less than a mile to the north, Universal Consolidated Oil Co. is developing land owned by 20th Century Fox. And to the south about a mile, Continental Oil Co. is drilling its fourth well in an effort to confirm a discovery on MGM and Desilu lots.

Only last June, Union and Signal announced a 1,200-bbl. discovery on the acreage east of the new districts. The discovery is about 3 miles east of established production on the Signal-Richfield acreage.

**Future drilling . . .** Signal may develop the new districts from drilling sites located at Hillcrest Country Club and Rancho Park golf course.

A third drilling site is under consideration, and will eventually be added, but it may be well in the future before the company lays out the money needed to prepare and equip a soundproof drilling operation.

Two rigs, one on each golf course, are now drilling wells. Fourteen wells have been whipstocked from the two locations and several more can be drilled before a third site is needed. The wells are drilled to a total depth ranging between 8,000 and 10,000 ft.

The Signal-Richfield operation on the golf course is considered a model for town-lot drilling. The 4,500-bbl. production from the 14 wells is metered to a Union pipeline by LACT equipment on each lease. The LACT facilities can handle up to 4,000 bbl. daily per lease and have only 500-bbl. storage. All wellheads are underground and no pumps are needed since the wells are all flowing.

In addition to the crude, the leases produce 15,000 M.c.f. of gas daily and 9,000 gal. of liquid products. A vapor-recovery system prevents any hydrocarbons from being vented.

Drilling rigs have been modified to keep noise to a minimum. City ordinances force operators to use electric rigs and to keep all openings closed entirely from 6 p.m. until 8 a.m. Drilling is done at night.

Signal and Richfield's best evidence of quiet drilling is the fact that Rancho Park operations continued throughout the last two Los Angeles Open golf tournaments without disturbing the contestants.

PHOTOS IN THE **NEWS**

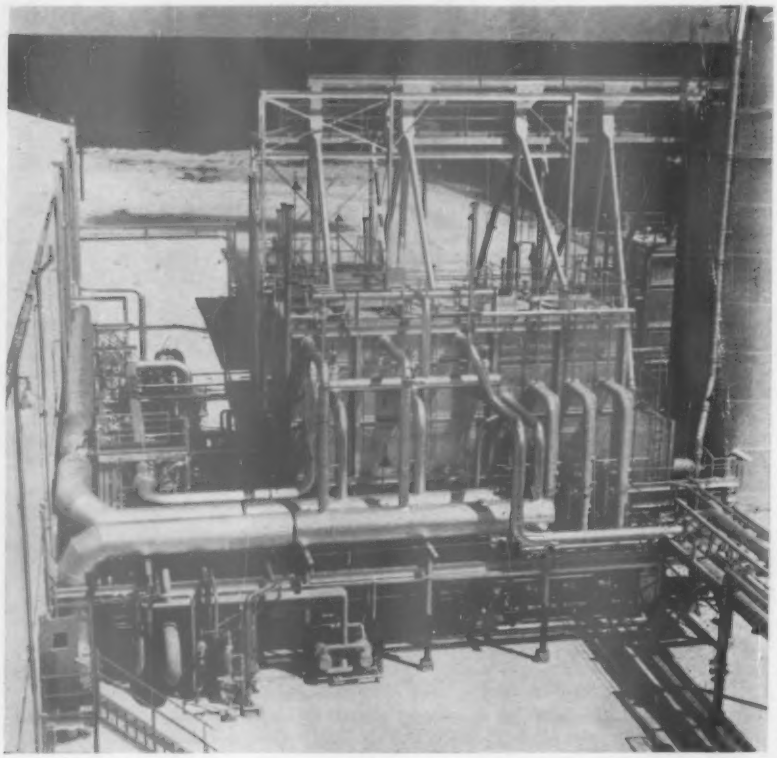
## New Iranian Terminal

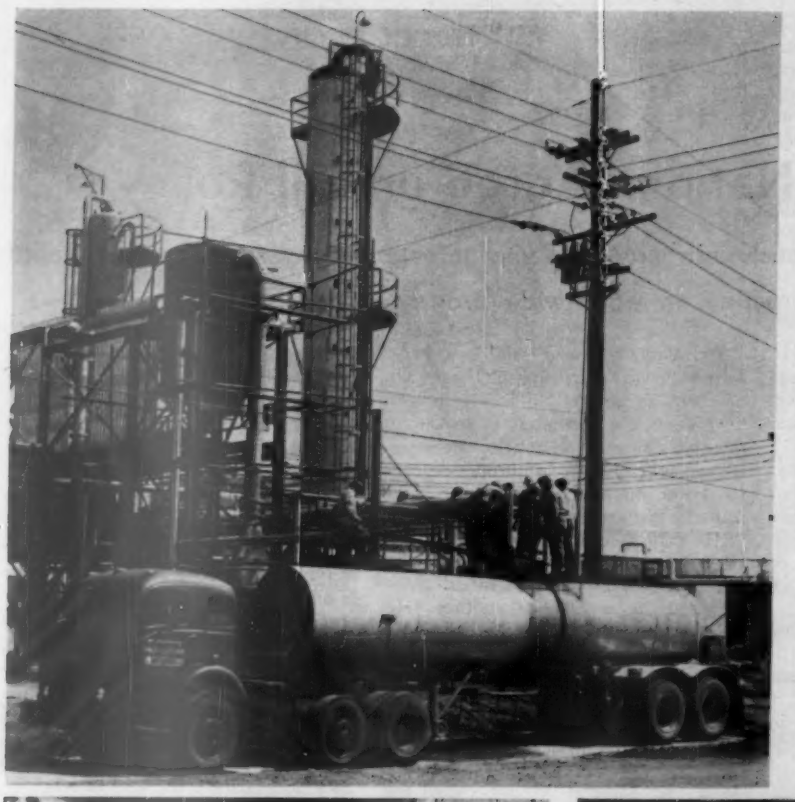
THE CONSORTIUM'S Kharg Island terminal began operations recently when Shell's tanker S.S. Heldia was berthed at the Persian Gulf facilities. Two of the four berths on the 2,000-ft. tanker jetty are now in use. The steel structure will accommodate tankers of 100,000 dwt. or larger. A 100-mile pipeline links Gach Saran field to Kharg Island. The line can deliver 350,000 bbl. daily by gravity flow.

## Cool Fuel Plant

A GUESSING GAME on the capacity of the Air Force's biggest liquid hydrogen plant has been ended with the release of official figures. The West Palm Beach, Fla., plant is capable of producing 60,000 lb. of liquid hydrogen daily which is used as a missile fuel.

Shown is the heart of the plant, the group of "cold boxes" where liquefaction of the ultra-cold fluid takes place. The plant, built by Air Products, Inc., has been in operation since early 1959.





## First Lion Sulfur

THE INITIAL RUN from the new sulfur-recovery unit at Lion Oil's El Dorado, Ark., refinery is loaded into an insulated trailer tank. The product from the unit, which has a capacity of 15 tons daily, will be used to make sulfuric acid at the nearby Monsanto Chemical Co. plant. Some of the acid will be returned to Lion for use in the treatment of product streams at the refinery.

## Project HOPE

PRINCIPALS at the commissioning of SS HOPE, privately financed medical school ship, were (from left) L. F. McCollum, president of Conoco, Vice President Richard M. Nixon, and Dr. William B. Walsh, founder of the project. McCollum is chairman of the board of HOPE. Oil companies contributed funds to fuel the ship for a year.

## Gas Bricks

THE RUSSIANS have developed a "solid petrol" which can be burned as a briquette. When liquid fuel is needed the blocks are squeezed to release the gasoline from plastic-film honeycombs in the bricks. They contain up to 15.8% by weight of either liquid fuel or liquefied gas. The Russians originally reported a 95% gasoline content.

# Big Exporting Nations Agree on Oil Policy

**• Baghdad conclusions may have vital effect on the oil industry. They could result in joint action on world-wide proration and crude-oil prices.**

DELEGATES from the five leading export countries have wound up a meeting at Baghdad that could have far-reaching consequences for the oil industry.

Representatives of Venezuela, Iraq, Kuwait, Saudi Arabia, and Iran have signed a series of agreements that could lead to joint action on crude prices and world-wide proration. A sixth country, Qatar, attended as an observer.

Specific terms of the decisions now being returned to the five governments for ratification have not been revealed. But the basic points, if carried out, would bring changes in the relationships between oil companies and host governments.

Here is what they are:

... **Joint action** and coordinated policy in matters of mutual interest.

... **A study** of ways to maintain price stability, including proration plans.

... **Elimination** of the recent price cut through joint pressure on companies.

... **Insistence** on the right of consultation with companies before future price changes.

There are serious stumbling blocks to the united front. One is the world-wide crude surplus. Another may be a reluctance by some governments to put a voluntary brake on fast-growing crude production. A third problem will be a production allotment to new crude producers.

But in any event, the conference has given impetus to the idea of joint action by producing countries. It has brought together rival areas in the case of Venezuela and the Middle East, and it crossed lines of regional antagonism in the case of Iran and the Arab states.

**Leaders optimistic** ... Venezuela's Dr. Juan Pablo Perez Alfonzo, who has long pressed for an international oil compact scheme was jubilant with the formation of the Organization of Petroleum Exporting Countries (OPEC), the agency set up to promote the joint policies of member countries (OGJ, Sept. 19, p. 80).

Dr. Perez Alfonzo said "we have formed a very exclusive club and no one will be allowed to join it unless he obtains the uanimous approval of the five founding members. Between us we control 90% of crude exports to world markets, and we are now united. We are making history."

He expressed a belief that the rules of the new organization will prevent the possibility of one member benefiting at the expense of another. He said this will prevent a loss of Venezuelan customers to other markets as the result of the country's policy forbidding discounts in excess of 5% off posted prices.

Shaikh Abdullah al-Tariki, Saudi Arabian Director General of Petroleum and Mineral Affairs, called the conference a "personal victory." He said his prorationing ideas have been adopted as a framework for the future relationship between exporting countries in OPEC. Member countries, he said, from now on will refuse any increase in their production at the expense of the quota share of other fellow members.

"I have always stressed the fact that, divided, the producing countries are powerless and they have now come to realize this. This is a turning point in our history," he said.

Kuwait's senior oil official, Ahmad al-Sayyid Omar, was confident that all governments concerned would ratify the resolutions. He said that companies should have consulted the governments of producing countries before the recent cuts and presented their justification for the move.

In the future, he said, companies will have to justify their action before the community of exporting countries.

# India's Oil Plans Hit Snags

THE INDIAN Government is getting unwelcome refining news from both the private and public corners of the local oil industry.

On the side of private enterprise, Burmah-Shell is holding out for a major expansion of its Bombay refinery in the face of government requests for an entirely new plant in southern India. The government has received bad news from its own Gauhati refinery project, where the cost may be double the original $21-million estimate.

Burmah-Shell is seeking permission to expand its Bombay facilities from 52,000 bbl. to 78,000 bbl. capacity. The government has delayed consent because it believes a new plant at Madras or Cochin would be more economical. The company contends that a new plant in southern India would cost double the addition of similar capacity at Bombay. This would more than offset the added transportation cost of products.

Complicating matters are coming negotiations for proposed revisions to the refining agreement under which the existing Burmah-Shell plant was built. Any changes are likely to carry over to Stanvac and Caltex refining operations, which supply a smaller share of the local market.

India wants to eliminate "duty protection," an arrangement that offers a degree of protection to profits for a certain number of years. Last year, Burmah-Shell voluntarily gave up the protection on all Bombay products, while the clause had 5 years to run. Stanvac and Caltex gave up protection on gasoline alone.

The government also is pressing for a new price formula on locally manufactured products that will free them from world prices.

**Problems at Gauhati** ... The 15,000 bbl. refinery at Gauhati in northeastern India may cost as much as double the $21 million originally estimated by the government.

This is because the original figures did not include the cost of offsite facilities, a water supply, and a need for pilings because of unsatisfactory soil conditions.

# Turkish Strikes Spur Interest

**. . . in oil hunting. And, there's a market waiting for any commercial production from the three latest finds.**

WIDELY separated discoveries have suddenly brightened Turkey's exploration outlook.

The latest find is by Royal Dutch-Shell 30 miles northeast of Diyarbakir in southeastern Turkey. The wildcat, not immediately identified, flowed 22 bbl. of 38°-gravity crude on a 108-minute test from 6,233 ft. The operating company, N. V. Turkse Shell, plans to deepen the test to 9,842 ft.

While neither the new well nor two earlier finds hold out immediate promise of production on a Middle East scale, any commercial production will have a waiting market. Government-operated fields about 60 miles east of the Shell find supply only about 6,500 bbl. daily out of a total domestic demand of 40,000 bbl. daily.

Shell also has one of the other finds, at Kuleli 1,022 miles east of Edirne, in northwest European Turkey. Oil and gas shows were encountered at 8,850 ft. in Tertiary. The well is located on acreage pooled by Shell and a German company, Deilmann Petrol, after poor results in individual programs.

Mobil International has the third find at Bulgardag 1, 40 miles inland from Mersin, in South Central Turkey. The Mobil find is approximately 300 miles west of the latest Shell success.

Mobil is drilling ahead at 1,482 ft. in a stepout less than half mile to the south. The discovery tested 1,200 bbl. daily from about 4,700 ft. after treatment. A wildcat at Chakit, 7 miles southwest of Bulgardag, has been abandoned as a dry hole. Mobil has 56% interest in a refinery under construction at Mersin.

Esso Standard (Turkey) recently called off its Turkish exploration program after spending $20 million in 6 years in a futile search for oil. The company drilled a total of 11 dry holes in all districts where it held licenses.

# Algerian Crude Pipeline Ready for Operation

A MAJOR new oil supply will enter world markets this week with the official opening of the crude pipeline from eastern Algeria to the Mediterranean Coast.

Ceremonies commemorating the first official tanker loading of Edjele crude at the Tunisian port of La Skhirra are scheduled for October 1. Loadings already are being made in a series of tests on pipeline installations, which are operating on a limited basis.

The 460-mile 24-in. system will move crude from Edjele, Tiguentourine, and Zarzaitine oil fields in the eastern French Sahara near the Libyan border. The fields are operated by CREPS. Royal Dutch-Shell has 35% interest and French Investment companies and the government the remainder.

Initial capacity of the line is 144,000 bbl. daily. This will be increased to 190,000 bbl. daily early next year when expansion of pumping facilities is completed.

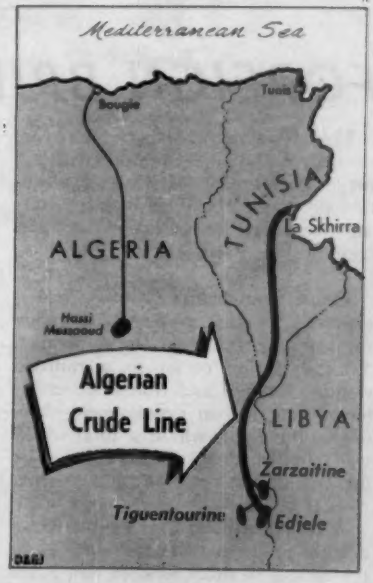
Markets have been found for most of the output from the Edjele area for 3 years. The French timetable calls for an output of 40,000 bbl. daily this year, and from 170,000 to 180,000 bbl. daily in 1961. Production in 1962 will average from 170,000 to 220,000 bbl. daily.

La Skhirra is only a few hundred miles further from European ports than the Hassi Messaoud terminal at Bougie. It is 730 miles to Marseille and 2,430 miles to Rotterdam. This is against a 1,600-mile trip to Marseille from eastern Mediterranean terminals of Middle East pipelines, and a 4,850-mile run to Marseille from the head of the Persian Gulf via Suez.

TRAPSA, the transportation subsidiary of CREPS, built and will operate the pipeline. Bechtel Mediterranean, a subsidiary of Bechtel Corp., San Francisco, provided services, studies, and supervision of the project.

The line runs northward along the Libyan border from a gathering station at In Amenas. It crosses into Tunisia and continues northward to La Skhirra on the Gulf of Gabes. A right-of-way agreement was reached with the Tunisian Government before construction began.

**Shallow production . . .** The discovery at Edjele 4 years ago was the turning point in the North African oil play that has become one of the fastest moving in the history of the industry.




A find at Tiguentourine was made the same year, and the best field of the group, Zarzaitine, came in 1957.

# Big Siberian Plant on Stream

**. . . but operations are limited. Overloaded railway will haul crude supplies until pipeline is finished.**

RUSSIA'S first major refinery in eastern Siberia has gone into limited operation.

The Angarsk refinery will supply products to the fuel-short area around Lake Baikal. The Soviets have not disclosed its design capacity, but the plant is probably in the 120,000-bbl. class.

The plant was put on stream on a limited basis to coincide with a Communist Party meeting in Moscow. Many facilities will not open until next year.

Crude supplies temporarily are being brought in by tank car via the overloaded Trans-Siberian Railroad. The refinery later will be fed by the 2,300-mile 25.5-in. pipeline being built from Second Baku to Irkutsk.

The line was originally scheduled to reach Irkutsk by the end of this year. Spreads are on the final leg, laying pipe east of Krasnoyarsk.

## *Pemex in Bolivia?*

PETROLEOS Mexicanos is thinking BIG.

The Mexican government oil agency is negotiating with the Government of Bolivia with a view to exploring for, producing, and refining Bolivian oil.

Alfonso Barnetche, head of production, and Eduardo Guzman, assistant manager of exploration for Pemex, will go to Bolivia this week for further discussions of the proposal. Bolivian representatives met last week in Mexico City with Pascual Gutierrez Roldan, Pemex director general.

Emphasizing the international thinking of Gutierrez is the fact that Pemex already this month had entertained oil delegations from Brazil and Argentina, presumably with a view to some sort of joint international operations.

# *FOREIGN BRIEFS . . .*

**Five Russian** oil experts have arrived in Pakistan to discuss Soviet aid for a government-sponsored exploration program. The Russians are offering technical help, equipment and credit.

**Crude from India's** Cambay field is expected to start moving to Bombay for refining next year via a planned 5-mile pipeline outlet to a railroad station. Russian and Romanian crews have four rigs on development drilling in the field, where a total of 19 wells are scheduled for completion by the end of the year.

**A fourth wildcat** in a Puerto Rican drilling program is below 4,900 ft. at a location 50 miles west of San Juan. Kewanee Interamericana Oil Co. moved its outfit to Punta de Las Tunas after three dry holes on the south side of the island. Name of the test is Kewanee Commonwealth of Puerto Rico 4.

**An open-flow potential** of 140-million cubic feet daily after acid treatment has made Sui 7 the best well so far in Pakistan Petroleum's big gas field in West Pakistan. The well was completed at a final depth of 4,450 ft.

**Bids are being asked** on a 17-mile 6-in. pipeline from Israel's Zohar gas field to the Dead Sea. The line is scheduled to open in February 1961. The Israeli Government will own 40%, while 10% each will be held by Naphtha Israel, Lappodot IOP, Israel National Oil, Delek Fuel, and Sonol. Other groups will hold the remaining 10%.

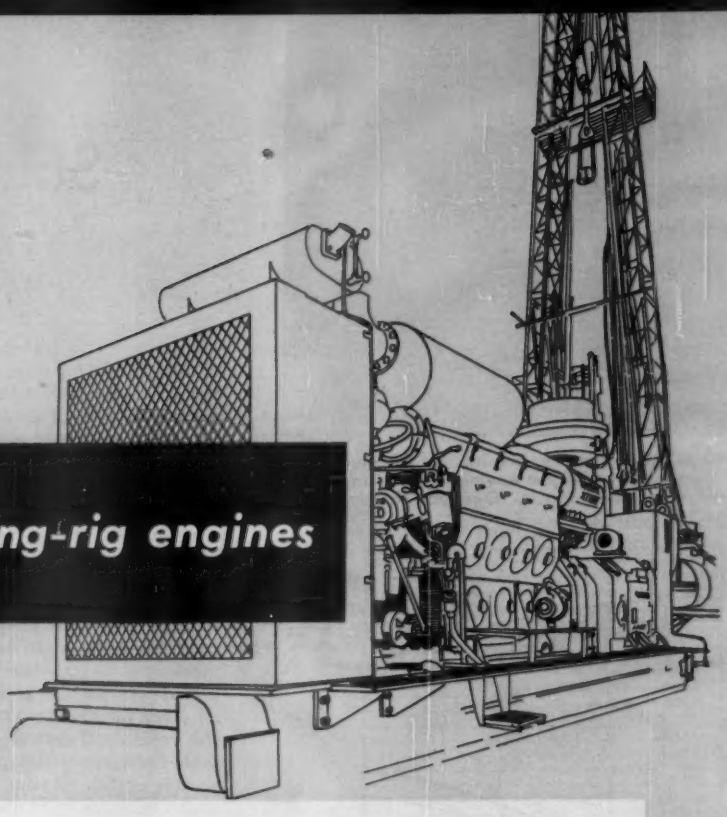
**The Afghan Government** says the oil discovery in mountainous northern Afghanistan is a 20-ton, or about a 140 - bbl. - daily well. The find was made by Russian technicians 40 miles south of the Soviet border. The Soviets heralded the find as a major discovery earlier this year (OGJ, May 30, p. 76).

**An Australian wildcat** on Mornington Island in the Gulf of Carpentaria is now scheduled for spudding in mid-October. The test, originally slated to begin in August, was set back when the ship bringing in a drilling rig ran aground on a reef. Delhi Australian and associates will drill the well, their third in Australia. The other two were dry.

**Tapline crude movements** are down to about 50% of capacity because of the competition from low tanker rates. During the first 8 months of the year deliveries of Saudi Arabian crude from the Sidon, Lebanon, terminal averaged 234,016 bbl. daily.

**A petrochemical plant** for producing polyethylene resins will be built near Le Havre, France, as a joint venture of Cie. Francaise de Raffinage and the newly formed El Paso France-Afrique, a subsidiary of El Paso Natural Gas Products Co. Construction on the $17 million plant is scheduled to start early next year and completion is expected by early 1963.

SPECIAL SECTION



# More from drilling-rig engines

BY ED McGHEE
Drilling Editor
PHOTOS BY CARL HOOT

THE DRILLING CONTRACTOR spends more money each day to keep his rig engines running than he does for any other item except labor.

True, most of the daily engine expense is for fuel. Even though cost of routine maintenance, repairs, and depreciation is less, the engines represent a large expense in all these areas. Thus, no contractor can afford a casual approach when buying and operating his power plant.

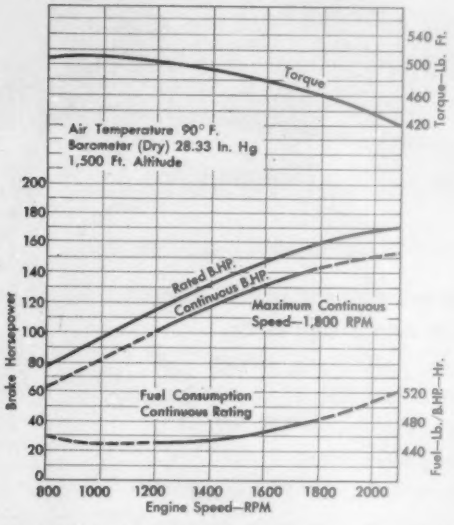
It is quite important that the right engines be selected. For instance, an undersized model may gulp fuel and need frequent, expensive repairs. Too large an engine certainly costs more to buy, and it may be difficult to move and have poor efficiency at part-throttle.

After the engine has been installed on the rig, the surest way to get good service from it is to maintain it carefully. Be sure your motormen know what's expected of them in servicing the engine. Make certain they comply. If you do, you may increase the service between overhauls by one-third or more.

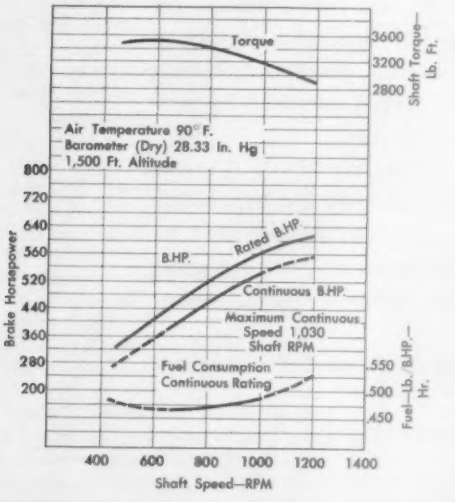
Another important point: Don't push the engine too far. If it shows signs of needing overhaul, put it in the shop immediately. Do this before the engine fails completely and damages parts which would not need replacement otherwise. There's a tendency for contractors to postpone every expense as long as possible. If that expense is an engine overhaul, waiting usually costs more than prompt attention.

In the following pages you will find more details about drilling engines, we think you'll find this information of value.

**PUNISHING LOAD** put on rig engines by the mud pump makes it necessary to derate engines below nameplate horsepower. Oil-field saying is, "Overload the pump, not the engine."




**HIGH-SPEED** diesel-engine performance curves. Notice that power for continuous horsepower is below that for intermittent rating. Though draw works is intermittent load, intermittent rating cannot be used.




**SLOW-SPEED** diesel-engine performance. In comparing fuel consumption of one engine against another, check over the entire operating range of the engine, not just at the most efficient speed.

# SELECTING the

## It's the first and most

IT IS SELDOM that the drilling loads are divided equally among the rig engines. That is, the No. 1 engine may almost always drive forward to the draw works and rotary; it may be seldom used on the pumps.

The No. 3 engine may not drive forward as much as the No. 2 engine.

Even so, universal practice is for all engines driving into the same compound to be identical, all the same horsepower as is required of the one most heavily loaded.

The horsepower that the engine is expected to deliver on the rig is not the same as the manufacturer's rated horsepower. In fact, manufacturers give their engines two ratings—the power for intermittent loading and the power for continuous service.

The intermittent rating is the horsepower which the engine will deliver at its maximum allowable speed with the throttle full open. No manufacturer cares to see his engine run under so high a load for more than a few minutes at a time; service life would be quite short if the intermittent power were taken off the engine steadily.

The continuous-load horsepower is about 80 to 90% of the intermittent-load rating. This continuous rating is delivered at a lower speed and at part throttle. Under such conditions, the engine should be able to drive most loads without undue wear on a 24-hour basis.

**The horsepower to buy.** It is true that the draw works of a drilling rig is an intermittent load. The engines first run at full load to pull a stand of pipe. Then they idle back while the blocks fall. Still, during the course of a trip out of the hole with drill pipe, full power is taken from the engine many times each hour. Such frequent repetition of full rated intermittent load would be too hard on an engine.

Even the continuous rating doesn't completely solve the problem for rig drives. In the first place some catalog ratings may be for a stripped-down engine with neither radiator fan nor water pump. Since these items are essential on a rig, the engine must be derated to take them into account.

The engine must be derated further if it is to drive a pump. Reason is that the mud pump is an extremely punishing load for any engine. This fact gives rise to the old field saying, "Overload the pump, not the engine."

Because of these things, it has become common in the oil industry to derate an engine to 65% of its intermittent horsepower for rig service.

Moreover, an engine loses power with every foot of elevation above sea level and must be derated for the altitude where it works. For example, an engine from coastal Louisiana could deliver only 80% as much power if moved into the mile-high Denver area.

The altitude derating is necessary because less air can be drawn into the cylinders at high elevations. It is also true that less air can be drawn in the engine cylinders in extremely hot weather. Both heat and elevation thin out the air. Thus, an engine working in

# right engine

## important move to economy

extremely hot areas must be derated because of the heat.

Still another derating is necessary if the engine is to drive through a torque converter or a fluid coupling. The fluid coupling is more efficient than the converter but may take as much as 3 to 5% of engine power.

Remember that as engine parts wear, some power is lost. As a result, the new engine should have some reserve power so that it will still be adequate for the job when it has several thousand hours of operation behind it.

It is always better to buy slightly larger engines than needed than to buy slightly smaller ones. Reason is that on a dollars-per-horsepower basis, the larger engines are cheaper to maintain. For example, one contractor bought 1,080 hp. of engines for a new 8,500-ft. rig. His old rigs of this size had less than 900 hp. The larger engines on the new rig paid out their extra costs through cheaper maintenance alone in 3 years.

Besides, the extra power probably helps cut costs by making trips faster and carrying jet-bit drilling deeper.

**Next, the fuel.** Once you know how much horsepower rating you need, you must decide if the rig should have gas engines or diesel engines. In times past there was seldom any question. On many locations natural gas was furnished free or at very low cost. If there was no natural gas, LPG (butane and propane) could be bought quite cheaply. In those times fuel cost so little for a gas engine that diesel engines were seldom considered.

Even though gas costs much more today than even a few years ago, it is ordinarily the clear choice as fuel where it is available close at hand. Reason is that the gas engine costs less to buy, less to run, and less to maintain.

The picture changes, however, when no natural gas is available and the gas engine must fall back on LPG as fuel a large portion of the time. Fuel costs with LPG are almost always higher than fuel costs for a diesel engine. As a result, diesel engines have become increasingly common for drilling-rig service.

As an example of relative fuel costs, take two 10,000-ft. rigs working in a West Texas field where separator gas is plentiful. If one rig's engines burn gas, total fuel bill might run only $25 per day. If the second rig is diesel, fuel expense on an ordinary day might be $75.

But suppose that the gas supply is shut off for some reason. Then, the gas-engine rig must switch over to LPG. Fuel costs might shoot up as high as $130 per day.

In addition, wells are drilled much faster today than ever before. Consequently, the rigs move much more often. This fact makes it harder and harder to justify the expense of laying a gas line to each new location.

**Where will the rig drill?** Actually, the fuel problem is an individual one with each rig. Perhaps the con-

**Percentage of Rated Horsepower at Altitudes Above Sea Level**

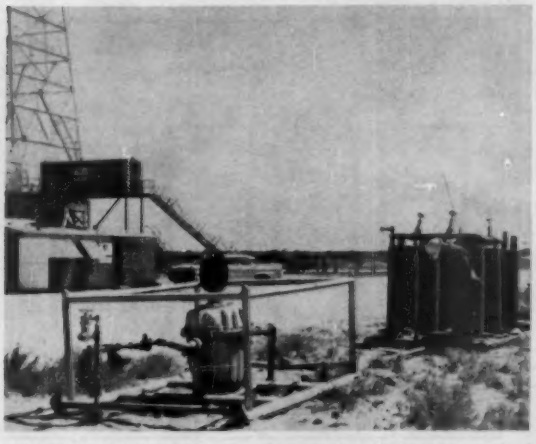
| Altitude (ft.) | Per cent of rated hp. |
|---|---|
| Sea Level | 100 |
| 500 | 98 |
| 1,000 | 96 |
| 1,500 | 94 |
| 2,000 | 93 |
| 2,500 | 91 |
| 3,000 | 89 |
| 3,500 | 87 |
| 4,000 | 85 |
| 4,500 | 84 |
| 5,000 | 82 |
| 6,000 | 79 |
| 7,000 | 76 |
| 8,000 | 73 |
| 9,000 | 71 |
| 10,000 | 68 |
| 12,000 | 63 |
| 14,000 | 57 |

**Percentage of Rated Horsepower at Air Temperatures Above 60° F.**

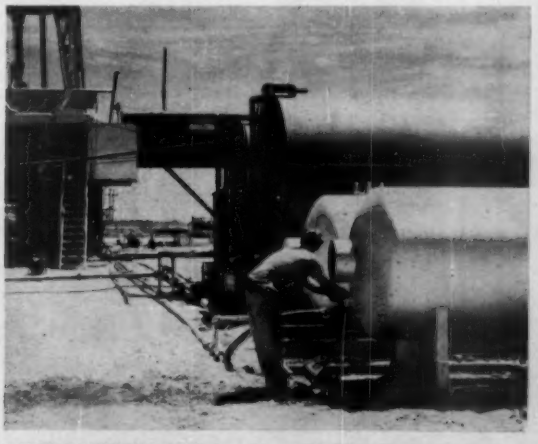
| Outside temp. (°F.) | Gas engines | Diesel engines |
|---|---|---|
| 60 | 100 | 100 |
| 70 | 99 | 100 |
| 80 | 98 | 100 |
| 90 | 97 | 100 |
| 100 | 96 | 97.5 |
| 110 | 95 | 95 |
| 120 | 94 | 92.5 |
| 130 | 93 | 90 |
| 140 | 92 | 87.5 |

Reprinted from AAODC's Toolpusher's Manual

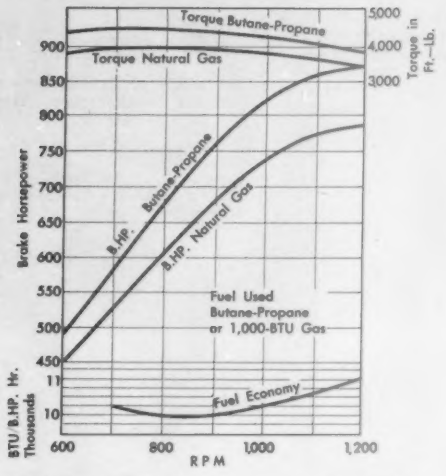
**FURTHER DERATING** is necessary to correct engine's power output for altitude and for air temperature. Manufacturer's horsepower ratings are often based on 60° F. air temperature and sea-level elevation.



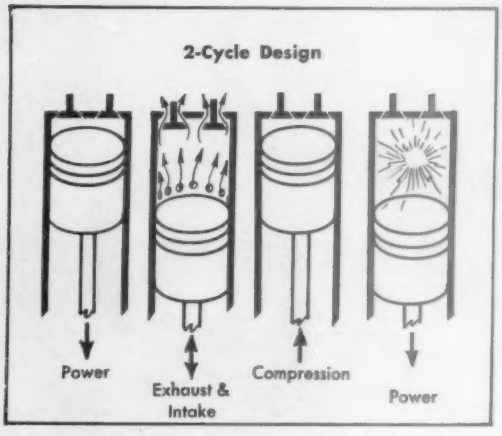
**NATURAL GAS** is almost always the best engine fuel when it is available close at hand. The gas-burning engine is cheaper to buy and cheaper to operate and maintain. Scrubber removes liquid and solid trash from field gas.



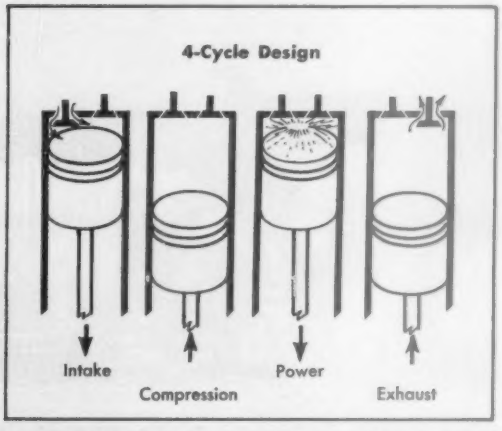
**WHEN NATURAL GAS** is not available, gas engines can burn LPG (butane-propane mixes). Cost of operating an engine on LPG is even higher than on diesel fuel. Thus, LPG is seldom used steadily.




**MORE HORSEPOWER** can be taken out of the engine when burning LPG than when burning natural gas. Notice that fuel consumption in gas engines cannot be directly compared with consumption for diesels.




**TWO-CYCLE ENGINES** have a power pulse on every revolution and, as a result, weigh less for each each horsepower. Two-cycle diesels are often used on rigs, but all gas engines are four-cycle.




**FOUR-CYCLE ENGINES** have power pulse from each cylinder only once each second revolution. Four-cycle diesels, unlike two-cycles, can be supercharged readily.

tractor needs a unit for wildcat drilling in remote areas where no gas is available; if so, only diesel engines are practical. Perhaps the rig is to go onto a barge or a platform or into a populated area; then, LPG might be too dangerous to use. Or, the rig may be wheel-mounted and move too often to lay a gas line to each location.

On the other hand, the contractor may want the rig only for in-field drilling where gas will always be plentiful and cheap. Or, bottled gas may be necessary on a few locations only.

Occasionally, neither the gas engine nor the diesel clearly promises lower fuel costs. If not, more thought must be given to such factors as purchase price, weight per horsepower, maintenance cost, general performance, and availability of replacement parts.

At one time dual-fuel engines appeared to be a good answer to the diesel-vs.-gas problem. Such an engine can burn either straight diesel oil, or it can burn only a small pilot charge of diesel with the remaining fuel being gas. While dual-fuel machines perform well in some other services, and while they have made a savings on some rigs, their over-all fuel efficiency has not been good enough to bring them into common use.

If the final decision is made for a gas engine, the problem is one of making a choice among the various manufacturers' models; all gas engines used on drilling rigs are four-cycle and none are supercharged.

Selection of diesel engines is more complex.

**Comparing diesels.** Both two-cycle and four-cycle diesels are used for drilling service. Many of the four-cycle models are turbocharged. Here are some points on which these various diesels may be compared: amount and cost of fuel consumed; weight per horsepower; initial cost; length of service life; ease and cost of service in the field; and response to the driller's throttle.

Engine manufacturers uniformly recommend that the four-cycle diesel be turbocharged. The turbocharger has proved an inexpensive means of getting more horsepower out of every pound of engine. True the turbocharged engine is not as responsive to the throttle as the naturally aspirated model, but the turbocharger makes each engine horsepower cheaper to buy and cheaper to maintain.

Two-cycle engines for drilling service cannot be effectively supercharged.

**Comparing fuel cost.** No two rigs have exactly the same equipment. Sprocket ratios may be different; pump strokes may be longer in one than another; drill pipe and drill collars may be larger and heavier on one. Or, one rig may even have torque converters to cause a loss of efficiency.

As a result of such dissimilarities it is difficult to compare fuel costs between engines on different rigs. Even if two rigs are identical in every respect and drilling side by side, the way the driller handles one can make it use more or less fuel than the other.

To offset these rig problems, engine manufacturers test their products on dynamometers in the shops. They report the fuel economy of their diesel equipment in terms of the pounds of fuel burned per brake horsepower per hour. Thus, a 0.44 or 0.46 figure means that the engine burns that fraction of a pound of fuel for each horsepower delivered each hour. These decimal figures are called "brake specific fuel consumption."

To be meaningful, a comparison between two en-

gines must be made with the same fuel. Diesel fuels differ in their B.t.u. content from a low of about 18,600 to a high of about 19,700 B.t.u. per pound.

It is not enough to make the fuel comparison of two engines at their most efficient speed. The specific fuel consumption is different at different speeds within the operating range of the engine. It might be 0.44 at 700 r.p.m. and 0.57 at 1,200 r.p.m. Since a drilling engine operates only partially loaded or at idle much of the time, the engines must be compared at part throttle as well as at full operating speed.

**Gas consumption.** Since natural gas and LPG mixes vary so much in their B.t.u. content, the gas engine must be rated on a different basis from that of the diesel. You will find that the manufacturer reports his gas engine's fuel consumption in terms of the number of B.t.u.'s consumed per brake horsepower per hour. This figure refers to no specific fuel.

Field gas may contain as little as 1,000 B.t.u. per cu. ft. or as much as 1,130 B.t.u. or more. Commercial propane can be expected to have around 2,500 B.t.u. per cu. ft.; butane has around 3,000.

Of course the exact fuel consumption of a gas engine depends on its design, its condition, and its load. A typical value might be 10,300 B.t.u. per brake horsepower-hour at 700 r.p.m. and 11,000 B.t.u. at 1,200 r.p.m.

**Accessory equipment.** Three types of starters are used on rig engines. Light, portable rigs with low-horsepower engines customarily use battery-powered electric starters. Heavier rigs use either air-motor starters or small gasoline-engine starters; sometimes both are used on the same rig. The gasoline-engine starter is used on one engine which can drive the air compressor. After this engine has been started and run long enough to build up air pressure, the remaining engines are started by air motors.

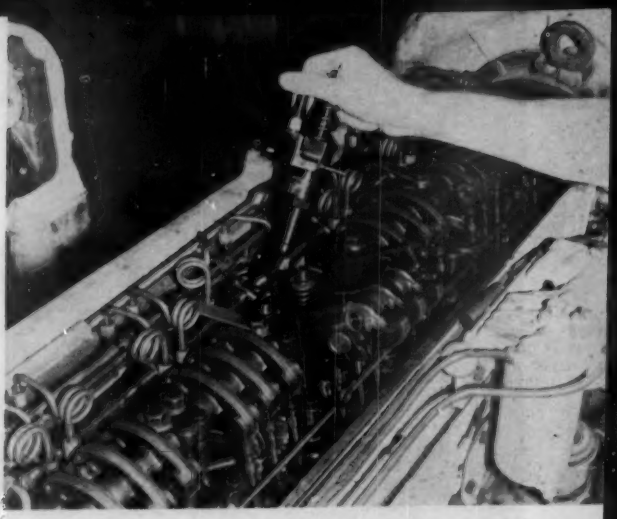
The pumping and hoisting loads on a drilling rig are ideal applications for a fluid coupling or a torque converter. No question, a "fluid connection" in the drive protects not only the engines but the driven equipment as well. Such drives are much smoother in operation. Consequently, it is easy to see a cash payout for a converter or fluid coupling on some rigs.

Naturally these drives are an extra expense to buy and they do require some maintenance. Also they reduce engine horsepower somewhat since they, like any transmission, are not 100% efficient. Such a lower efficiency means higher fuel costs.

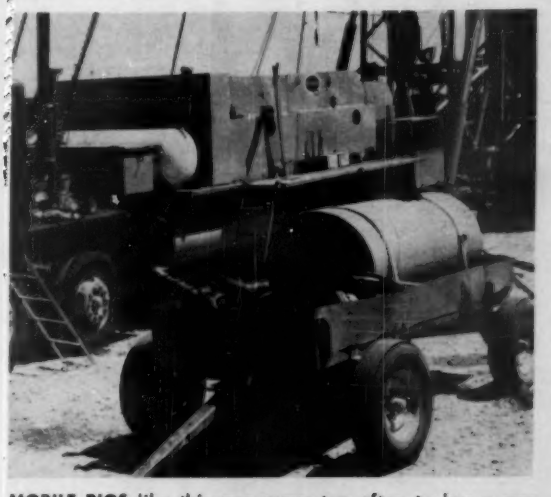
Generally speaking, the larger the engine the more attractive some type of hydraulic drive becomes. And, the more engine power the rig has for its size, the more advantage a torque converter or fluid coupling has. Engine and drive manufacturers can make recommendations on any particular rig.

**Two engines or three.** Usually, the drilling contractor has little choice about how many engines go onto a particular size rig. When he does have a choice, there are several things he must consider. First of all, the engine compound is cheaper when fewer engines are used. Second, the fewer engines there are, the easier a rig move is. And, third, two engines have only 66% as many parts to wear, fail, and repair, as do three engines.

Naturally, the rig must have some power remaining when one engine goes down unexpectedly. And, the more engines there are, the more power remains when one is out of service.

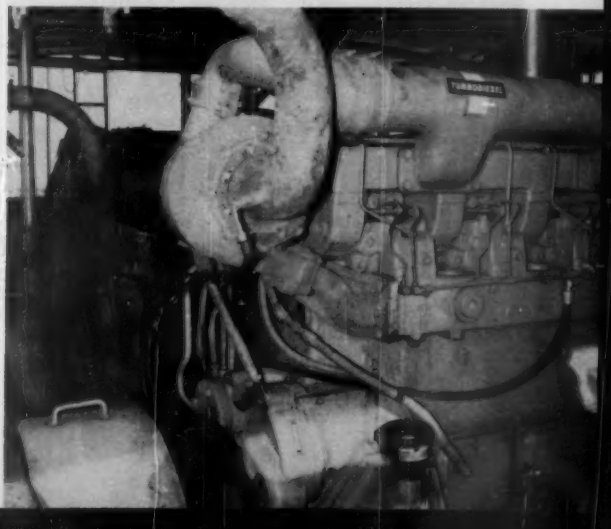


**DIESEL INJECTOR,** shown here as it is being removed from the cylinder head, illustrates importance of such factors as ease of service in field.



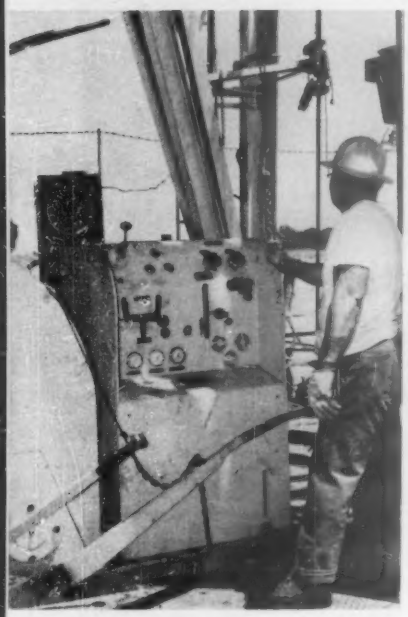
**MOBILE RIGS** like this one move too often to lay a gas line to each location. For such rigs, diesel fuel is only choice. Light weight is also important in such wheel-mounted units.

**TURBOCHARGER** is simple, inexpensive means of raising horsepower that may be taken from the four-cycle diesel engine. Gas engines and two-cycle diesels are difficult to supercharge.



# Careful operation good service and

**STARTING THE ENGINE** should not be attempted until a thorough check has been made. The check is especially important if the rig has been shut down for a long time.



**LUGGING** the engine down for prolonged periods is one of the most common and most damaging of operating practices on the rig. Don't overload the engine in this or any other way consistently.

**INTAKE-MANIFOLD** vacuum gages, here mounted on the radiator of No. 1 engine, are quick, effective means of checking of engine performance and of seeing if engines are synchronized.

ANY NUMBER of potential dangers can develop as the engine is moved, installed, and put into operation. The dangers are multiplied when the engine has been shut down for a long time.

First if the engine is not set and aligned properly, the crankshaft may operate with a pull, push, or side thrust. Engine crankshafts are not made for such loading; they are intended to take no other stresses than those developed in the engine. Failure can come quickly when the engine is misaligned or improperly coupled to its load.

It is important to check the engine thoroughly before any attempt is made to start it. This is especially true on new or recently overhauled engines. First, the radiator should be full of water with no signs of leaks anywhere in the system. The fan should rotate freely with bearings well oiled and the belt drive snug and in good condition.

Oil should be at the proper level in the crankcase and in the governor and fuel pump, if any. If necessary, filter holders and lines should be hand-filled with oil. Grease cups should be turned down and pressure fittings given a shot of lubricant.

Ignition, fuel, and exhaust systems should also be checked to make sure they are secure and unobstructed.

If the engine has been shut down for a long time, it should be turned over by hand or at slow speed by the starter before it is run. It may even be advisable to pour a teaspoon of oil through each spark-plug hole.

Make sure that the starting engine, if any, is full of oil and is otherwise ready to operate before cranking it. Before starting the main engine with the starting engine, remove all load possible from the output shaft. Don't make a practice of starting an engine by driving it with the compound; if there should be any water in the cylinders, the head might be cracked or the piston rods bent.

**After it's running.** Once the engine has started, it should be warmed up at idle speed for 5 minutes or more before putting any load on it; it takes this long for the working parts to get enough oil that they are not worn abnormally when the load is put on. Also, fuel doesn't burn completely when the engine is cold. As a result, fuel can wash down into the crankcase, causing scoring of cylinder walls and diluting the entire oil system. A diluted oil allows rapid wear of all moving parts of the engine.

Loading a cold engine can also cause delayed-ignition knocking. This condition leads to failure of head gaskets and to burned or cracked pistons and rings.

Immediately after the engine starts, check the oil pressure. If pressure is normal and if the engine seems to be running as it should, it is ready for load as soon as it warms up.

One of the most common mistakes in operating rig engines is to lug them down under too heavy a load for a long while. A few hours at such overload wears

# pays dividends in low maintenance

the engine as much as 100 hours at normal load. If the engines can't pull the rig pumps against standpipe pressure without lugging down, then smaller liners should be put in the pump.

Another harmful but common practice on rigs is to allow the engines to run for long intervals at full speed with no load. This not only wastes fuel, but it also wears the engine needlessly. The engine should be throttled back when the load is removed. If the idling period promises to be too long, it is best to shut down completely.

All engines driving into the rig compound should be checked regularly to see that each is bearing its part of the load. Gas engines are synchronized by keeping equal vacuum on intake-manifold gages. On diesel engines it is necessary to use exhaust pyrometers. Normally, vacuum-gage and pyrometer tests should be taken when the engines are under a normal load.

Remember that poor engine condition and other things can cause unusual vacuums and exhaust temperatures. For instance, a lean fuel mixture makes the engine run hotter than a correct mixture.

**Stopping the engine.** It is just as important to idle the engine for a time before stopping as it is to idle after starting. It may be necessary to idle the engine for as long as 10 minutes before stopping if it is especially hot. This idling period, with water pump and oil pump still circulating fluid, brings temperatures inside the engine down evenly. Thus, hot parts are not so likely to warp as if cooled unevenly.

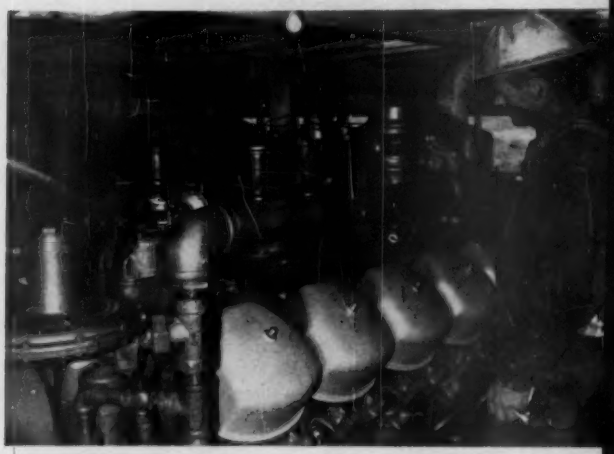
It is usually best to stop the engine by turning off the fuel first. Then, the ignition, if any, should be turned off. It usually is necessary to put some sort of protective cover over the exhaust so that no rain, snow, or dust can blow in.

**Engine safeguards.** The area around a rig's engines is noisy and hot; no one cares to be there unless it's necessary. Moreover there are long periods when no crew member is free to visually check the engines. For these reasons it is important to have emergency shutdown controls on each engine. Most controls shut off fuel supply or ground the ignition in case of low oil pressure or high water temperature. Other devices guard against overspeed.

Having such controls isn't enough. They must be kept in good operating condition and tested from time to time.

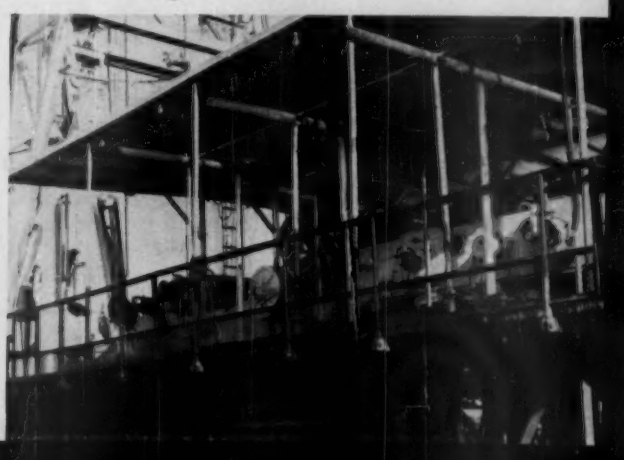
Another important but often neglected piece of engine equipment is the exhaust. If poorly installed, it can cause noticeable loss of power and serve as a path for harmful foreign material to get into the engine. Here are some good rules about the exhaust. Keep it short and of large enough diameter. Hang it from its own supports and isolate it from the engine with a short section of flexible tubing. Keep it horizontal so that rain and snow can't fall into it. Cover it when the engine is shut down for more than a day or two.

**EXHAUST PYROMETER** tells same information for diesel that vacuum gage does for gas engine. Here, pyrometer readings from all three engines may be taken from a dial on the driller's control panel.



**FUEL SHUTOFF VALVE** is closed any time oil pressure drops too low or radiator-water temperature goes too high. Having such controls isn't enough; they must be kept in good order.

**ENGINE EXHAUSTS** should be independently supported, big enough, and not too long. The exhaust should be horizontal, to prevent rain and snow from entering and reaching the engine. Do not connect starting-engine exhaust to main-engine exhaust.



# Trouble shooting on the rig engine

WHEN THE RIG ENGINE fails to work properly, the cause must be found and corrected promptly. Often no experienced mechanic is available. For such instances, the API compiled the following list of engine troubles and ways to locate the source of that trouble. As the API points out in its recommended practice for engines, most internal-combustion engines react in much the same way to specific problems.

## Gas-Gasoline Engines

**Difficulty in starting**

1. Ignition switch off.
2. Lack of fuel.
3. Oiled or fouled spark plugs.
4. Spark-plug gap too wide.
5. Low compression due to leaking valve.
6. Magneto points stuck open or held apart.
7. Dirty magneto points.
8. Magneto ground wire broken or grounded.
9. Engine flooded.
10. Water in carburetor or fuel.
11. Wet ignition system (spark plugs, magneto, wires).
12. Incorrect throttle setting.
13. Choke open (natural gas, except where metering valve is used).
14. Incorrect timing of magneto.
15. Incorrect valve clearance.
16. Air leaks in intake system.
17. Fuel system obstructed.
18. Improper fuel mixture.
19. Automatic safety devices not reset.
20. Vapor lock.
21. Ignition wires to wrong spark plugs.
22. Excessive exhaust back pressure.

**Failure to idle**

1. Idling jet restricted.
2. Incorrect idling-speed adjustment.
3. Throttle valve closed too far.
4. Cracked intake manifold.
5. Air leak in intake system.
6. Improper valve clearance.
7. Play in carburetor controls.
8. Faulty governor.
9. Incorrect float level (gasoline).

**Failure to develop full power**

(a) Faulty ignition

1. Ignition out of time.
2. Weak magneto magnets.
3. Burned or pitted points.
4. Defective or improper spark plugs.

(b) Incorrect carburetion

1. Mixture too rich or too lean.
2. Throttle valve not fully open.
3. Air leak in manifold.
4. Incorrect fuel pressure.

(c) Improper lubrication

1. Improper oil.
2. Oil temperature too high or too low.
3. Overhead valves not properly lubricated.
4. Oil cooler bypasses engine.
5. Stuck relief valve.
6. Clogged screens, filters, or coolers.

(d) Miscellaneous

1. Incorrect valve-clearance adjustment.
2. Weak valve springs.
3. Compression too low (rings and valves).
4. Exhaust or intake manifold restricted.
5. Engine stiff or tight (new engine).
6. Exhaust line restricted or of improper length or size, or both.
7. Air cleaner restricted or not serviced properly.

**Engine stops running**

1. Magneto grounded.
2. Lack of fuel.
3. Fuel lines obstructed.
4. Carburetor jets clogged.
5. Automatic safety devices for high water temperature, low oil pressure, or overspeed may have operated.
6. Vent for fuel tanks clogged.

**Missing on one or more cylinders**

1. Fouled spark plug.
2. Defective spark plug.
3. Broken or grounded plug wire.
4. Improper valve clearance.
5. Low compression on one or more cylinders.
6. Damaged distributor head.
7. Intake manifold or head gasket.

**Improper oil pressure**

1. Improperly adjusted relief valve.

2. Clogged strainer.
3. Improper grade of oil.
4. Excessive bearing clearance.
5. Oil too hot.
6. Clogged oil-pressure line.
7. Restricted oil cooler, filter, or screen.
8. Defective oil gage.
9. Insufficient oil.

**Excessive oil consumption**

1. Improper grade of oil.
2. Worn piston rings.
3. Stuck or broken piston rings.
4. Worn bearings.
5. Crankcase compression.
6. Overheating.
7. Leaking valve guides.
8. Excessive oil to intake valves.
9. Clogged oil ring or piston drain holes.
10. Worn oil seals on crankcase or piston rods.
11. Cracked crankcase.
12. Lubricator overfeeding (two cycles).
13. Abnormally low operating temperature, particularly from underloading.
14. High oil level in crankcase.

**Failure to stop when switch is turned off**

1. Magneto ground wire broken.
2. Engine excessively hot.
3. Excessive amount of carbon in combustion chamber.

**Overheating**

1. Insufficient coolant.
2. Radiator frozen or clogged (tubes and tanks).
3. Radiator core dirty (external).
4. Water hose clogged.
5. Slipping fan belt.
6. Leaky valves.
7. Improper fuel mixture (lean).
8. Carburetor choke closed.
9. Spark retarded.
10. Improper timing (valves and ignition).
11. Lack of oil.
12. Oil diluted or too light.
13. Thermostat stuck.
14. Cooling system inadequate.
15. Engine overloaded.
16. Excessive air recirculation.
17. Aeration of water from leaking gaskets or pump.
18. Defective water pump.
19. Excessive back pressure on external cooling system.
20. Improper synchronization of two or more engines.
21. Air shroud, air stack, cylinder-head fins, or cylinder-block fins plugged with debris.

**Excessive black smoke from exhaust pipe**

1. Carburetor float sticking.
2. Mixture too rich.
3. Wet gas or crude oil in the fuel gas.

**Excessive blue smoke from exhaust pipe**

1. Faulty piston rings.
2. Lubricating oil too thin.
3. Too much oil in crankcase.
4. Upper-lube feed too fast.
5. Worn valve guides.
6. Excessive idling.

## Diesel Engines

**Starting difficulty**

(a) Fuel failure, low-pressure side.

1. Line valves not open; tank empty.
2. Ice in lines or traps.
3. Cold fuel.
4. Plugged fuel filters, or dirt in lines between filter and pump.
5. Fuel tank too low in relation to transfer pump.
6. Dirt under transfer-pump valves or worn valves.
7. Air lock in fuel pump or injection pump.
8. Safety switch not being held open by operator.

NOTE: *The foregoing items may be checked by opening the bleeder valve and cranking the engine. A pressure gage should be used in the bleeder-valve hole to check for primary pump pressure. A hand plunger may be used on the transfer pump, if desired. A substantial flow of fuel without air bubbles should exit from the bleeder opening.*

(b) Fuel failure, high-pressure side.

1. Enrichment lever not in proper position. Rack partly closed in cold weather.
2. Stop control in wrong position.
3. Air locks in high-pressure lines.
4. Broken or disconnected pump-drive coupling.

NOTE: *The foregoing items may be checked by loosening line-coupling nuts a few turns at each nozzle and cranking engine. A substantial flow of fuel should occur at each injection impulse. If no fuel appears and an adequate flow of fuel is known to have reached the plungers, either the plungers or delivery valves may be stuck as a result of poor fuel, improper storage, or inadequate lubrication.*

(c) Poor nozzle spray pattern or gummed or corroded nozzles.
(d) Faulty injection timing.
(e) Glow plugs too cold.
(f) Battery voltage low. (A fully charged 12-volt heavy-duty battery at normal temperatures will show 10.5 volts while cranking.)
(g) Air cleaners may be clogged or protective covers accidentally drawn into the manifold.
(h) Poor compression. (Check each cylinder.)
(i) Liquid lock between piston crown and cylinder head due to flushing oil from storage, leaking head gasket, or leaking injector.
(j) Low cranking speed due to weak batteries, poor starter condition, or thick, cold oil.

**Engine stops running**

1. Lack of fuel.
2. Fuel lines obstructed or broken.
3. Automatic low oil-pressure or high water-tem-

## Trouble shooting on the rig engine (continued)

perature safety control may have operated.
4. Excessive overload or improper governor adjustment may cause the engine to stall.
5. Plugged fuel-tank vent.

**Low power**
(a) Inadequate supply of fuel to pump.
(b) Fuel-tank vent partially plugged.
(c) Faulty timing.
(d) Delivery valves not operating properly.
(e) Dirty or damaged injection plunger.
(f) Leaking fuel lines or air in lines.
(g) Damaged or excessive clearance in blowers.
(h) Overflow valve or injector drain line feeding back into primary pump inlet.
(i) Dirty or clogged nozzles.
(j) Air cleaner or manifold obstructed.
(k) Low or uneven compression.
1. Broken valve spring.
2. Sticking valves.
3. Badly worn rocker arms.
4. Sticking cam followers.
5. Bent throttle control linkage.
6. Binding of injector-rack control tube or injector racks.
(l) Fuel oil not to specification.
(m) Improper exhaust line.

**Surging or irregular speed**
(a) Governor needs lubrication.
(b) Improper grade of governor oil (hydraulic governors).
(c) Governor improperly adjusted.
(d) Injection pump.
1. Lack of lubrication.
2. Insufficient fuel supply for primary system.
3. Irregular operation of automatic bleeder valve; air entrainment in pump and lines, valves, or nozzles.
4. Inaccurate pump timing.
(e) Slipping clutch or belt drive; wide variation in loads or poor regulation on electrical equipment.

**Overheating**
(a) Excessive exhaust back pressure.
1. Restricted muffler or loose baffles in muffler.
(b) Cooling system.
1. Insufficient coolant.
2. Radiator frozen or clogged (tubes and tanks).
3. Radiator core dirty (external).
4. Water hose clogged.
5. Slipping fan belt.
6. Thermostat stuck.
7. Cooling system inadequate.
8. Improper air recirculation.
9. Aeration of water from leaking gaskets or pump.
10. Defective water pump.
11. Excessive back pressure on external cooling system.
12. Air shroud, air stack, cylinder-head fins, or cylinder-block fins blocked with debris.
(c) Combustion.
1. Improper fuel.
2. Faulty injection timing.
3. Faulty injection nozzles.
(d) Lubrication.
1. Improper or excessive time between oil changes.
2. Air-locked or plugged oil filter, cooler, or screen.
(e) Load.
1. Prolonged service at excessive load.
2. Improper synchronization of two or more engines.
(f) Installation.
1. High exhaust back pressure due to improper piping or muffling.
2. Insufficient air circulation when engines are operating in closed spaces.

**Low or fluctuating oil pressure**
(a) Oil.
1. Insufficient oil.
2. Dirty filters, oil coolers, or sump screen.
3. Improper grade of oil.
4. Foaming oil due to water leakage.
(b) Pressure regulation.
1. Worn, sticking, or loose relief valve.
2. Vent behind relief valve plugged.
3. Inaccurate pressure gage.
(c) Pump.
1. Inlet-strainer screen clogged.
2. Damaged or worn pump gears.
3. Clogged oil lines or passages.
(d) Mechanical.
1. Excessive bearing clearances on camshaft or crankshaft.
2. Cracked or broken oil line.
3. Leaking gasket on suction side.

**Knocking or unusual noises**
(a) Operation.
1. Unsatisfactory fuels.
2. Overloading (heavy black smoke).
3. Improper timing.
(b) Installation.
1. Engine loose on mounts.
2. Vibrational disturbances of loose control rods, air cleaner, muffler, or similar parts.
3. Loose accessories as generators, fans, compressors, etc.
(c) Mechanical.
1. Loose bearings on connecting rods, piston pins, camshaft, or crankshaft.
2. Loose flywheel or distorted housing.
3. Damage, looseness, or wear in water-pump, oil-pump, or fuel-pump drive.
4. Excessive crankshaft end play.
5. Improperly adjusted valves, sticking valves, rocker arms, or tappets.
6. Excessive time since overhaul (worn pistons, stuck or broken rings, carbon on piston crown).
7. Defective vibration damper.

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# Good maintenance means long life

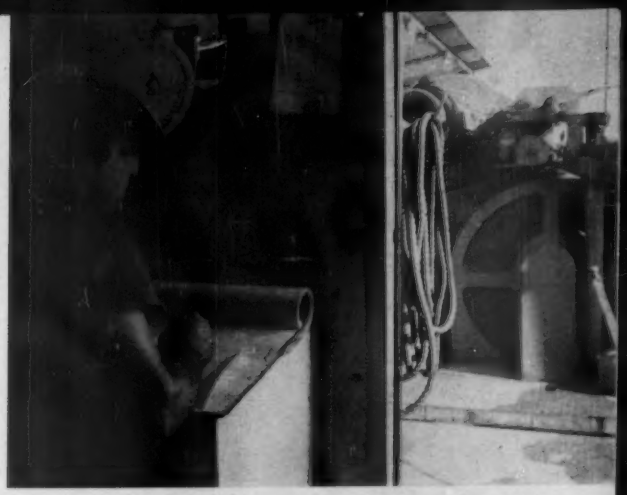
THE CONTRACTORS who get most for their engine dollar require the rig crews to inspect each engine regularly and to report on its condition. Following is the routine recommended by API and several manufacturers for rig-engine maintenance.

**Daily inspection.** All of the following things should be done each day and a record should be kept of the results:

1. While the engine is running under normal load, oil pressure and water temperature should be checked.
2. The engine should be shut down long enough for the oil to drain back into the crankcase; then the oil level should be measured and more oil added if need be. Also, a sample of the crankcase oil should be inspected to make sure it is still in good condition.
3. The radiator should be checked and fluid added if needed. The water should be checked to see if it is rusty, scummy, or oily; if so, the cooling system may need cleaning.
4. Air cleaners and breather caps should be checked and cleaned if necessary. Under especially dusty conditions, the cleaners may need checking several times each day.
5. Sump traps, fuel filters, and strainers in the fuel system should be drained.
6. Oil, fuel, and water lines should be traced out for possible leaks. If leaks are found, they should be fixed.
7. Grease cups should be turned down and grease added if necessary.
8. The engine record should be filled out completely and any mechanical malfunctions reported to the mechanic.

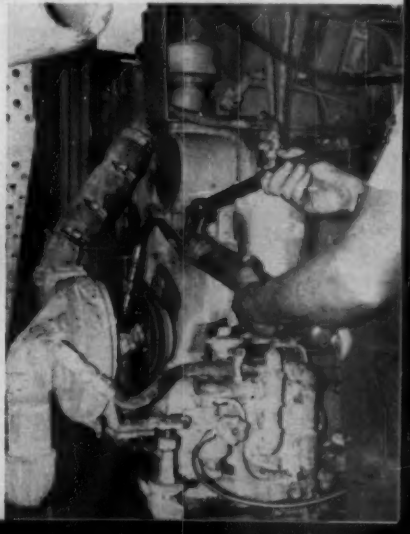
**Weekly inspection.** Each week, the following things should be done in addition to the daily check.

1. Outside of the engine should be cleaned with a mild solvent (not gasoline); then it should be dried with compressed air or hot water. During this cleaning, no trash should be allowed to get into delicate engine parts.
2. Water pump and fan belt should be inspected. If need be, the pump should be repacked and the fan belt tightened.
3. All breather elements should be cleaned in mild solvent (not gasoline) and oil should be changed in those requiring it.
4. On gas engines, the fuel-pressure regulators should be checked. Also, spark plugs should be taken out, cleaned, and regapped if necessary.
5. On diesel engines, the fuel-filter elements should be checked and replaced if scheduled. Also, oil level should be checked in the fuel-injection pump and the governor. If the oil is badly diluted in either, it should be changed, using the type recommended by the manufacturer. If oil is in good condition, add as needed.
6. The starting engine should be checked for oil



**KEEPING A RECORD** of the engines is important. It aids a systematic and regular program on engine maintenance. A careless approach means shorter engine life and more frequent repairs.

**EACH WEEK,** outside of the engine should be cleaned off with a solvent. The magneto, particularly, should be kept clean so that it does not ground out against the frame.

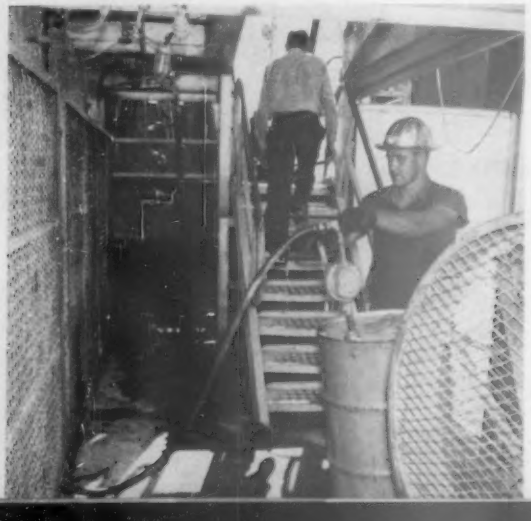


**EACH DAY,** many points on the engine need inspection and service as does this water pump. Water pump should not be overlubricated lest excess grease get into cooling system and clog it up.

**EACH MONTH,** many manufacturers recommend that the valve clearances be checked and the tappets reset if needed. Also each month, skilled mechanic should check over entire engine.

**READING ENGINE-MAINTENANCE MANUALS** is important part of engine care. If crew knows the manufacturer's recommendations for engine care and operation, they're better able to carry them out.

**ADD OIL** to the crankcase whenever it is needed. When the motorman checks the oil level each day, he should note whether the oil is in poor condition. If so, it should be drained without waiting for scheduled oil change.



level. Clutch controls should be lubricated and adjusted.

7. The entire engine should be given a visual inspection. Any leaks through gaskets should be corrected. Loose belts should be tightened. Strange engine noises should be traced down.

8. Safety shutdown controls should be checked. If there is any doubt about their operating properly, the engine should be started and the shutdowns adjusted.

9. The electrical system, whether for ignition, shutdown, or the like, should be checked out.

10. Throttle and governor linkages should be lubricated and checked to see that their movement is free.

**Monthly inspection.** It is well to have a skilled mechanic make an inspection of the rig engines once each month. At this time the engines should be checked with vacuum gages or pyrometers to make certain they are synchronized. The entire power plant should be tested out thoroughly.

Some manufacturers recommend that valve clearances be checked monthly. At this time any tappets not within specified limits are reset. Moreover, some recommend that the thermostat housing be removed each month and that any scale or deposits in the area be cleared away.

**When to change oil.** It is important that crankcase oil be changed out on a regular schedule. A haphazard approach to oil changes is certain to be costly as a result of shorter engine life and more frequent repairs. Again, it is important to keep a record of how much oil the engine uses; such a record will often show engine trouble before other signs become evident.

It's hard to make general rules about how long rig-engine oil should be run between changes. A premium oil needs changing less often than a cheap oil; an engine burning a low-sulfur fuel needs an oil change less often than one burning a high-sulfur fuel. In a worn engine, the oil is diluted more quickly and needs changing more frequently than the oil in a "tight" engine.

Notice how "clean" the engine is. If it continues to run clean, you can assume the oil is being changed frequently enough. If there is doubt, consult a lubrication engineer for the oil distributor; he can advise according to the engine's load, condition, location, fuel, etc.

You cannot judge the condition of modern lubricating oil by its color alone. Detergent oils hold fine particles of carbon in suspension so that they may become darker rapidly; such a dark color is a sign that the oil is doing its job.

Between scheduled changes, the crankcase should be drained and refilled any time the oil appears badly diluted, thickened by sludge, or in poor condition otherwise. Make it a practice to drain the crankcase any time there has been an engine failure which may have overheated or contaminated the oil.

Drain the oil while the engine is still hot. Doing so removes much of the solid matter suspended in the oil.

Each time the oil is drained, remove the side plates on the base of the engine and mop out all accumulated sediment there. There's no sense in allowing such trash to contaminate the new oil.

Each time the oil is changed, the filter elements should also be serviced. Make certain that the filter element is the proper type for the engine. Also, clean the oil-pump-inlet screen periodically.

**What oil to use.** You'll be well repaid if you buy

good-quality lubricating oil and fuel. A good-quality fuel contains less sulfur and makes the engine last longer. Besides, a high-sulfur fuel means oil must be changed more often.

Never add cheap no-additive oils to the crankcase. Always use oils which contain a detergent and additives to resist corrosion and oxidation.

Weight of oil to use depends, of course, on how hot or cold the weather is and how hot the engine runs.

**When to overhaul.** Some contractors have a regular program which calls for overhauling an engine after some certain number of hours, even if it still appears to be running satisfactorily. Of course, there's a lot to recommend such a program. For those who do not have a scheduled-overhaul setup, there's a tendency to run the engine even after it has clearly shown signs of approaching failure.

It's normal for the contractor to balance the cost of an overhaul on the one hand with the extra oil, fuel, and trouble the unrepaired engine means on the other. However, if the engine is allowed to run until it fails completely, it may not be repairable at all; a new engine may be necessary. At best, the overhaul expense will be several hundred dollars more than if the engine were put in the shop before complete failure.

Take the case of a badly worn bearing. The engine may run on such a bearing for many hours. Still, all the time, most of the engine's moving parts are taking a bad beating. Much more work will be required to restore engine performance than if the engine were repaired as soon as bad bearing was detected.

**For a long shutdown.** If it is likely that the rig is to be stacked for a long time, the engines need extra protection. They must be sheltered from the weather and processed to prevent damage that might result from corrosion within the engine itself. First, a preservative compound should be added to radiator fluid and to crankcase oil and, then, the engine run long enough to reach normal temperature. After this, when the engine is shut down, radiator and crankcase should be completely drained while still hot.

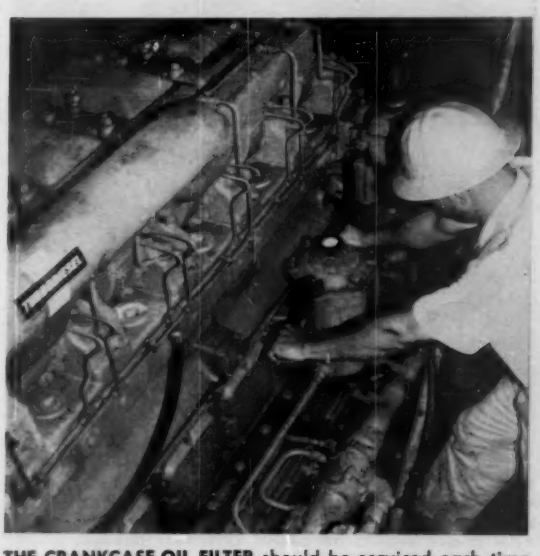
A preservative oil should be put in through the air intake while the engine is being shut down. In addition, it is good to put in e x t r a preservative oil through spark-plug holes. Tension should be relieved from the fan belts and all openings should be sealed with tape or the like. Breaker cams in the magneto should be coated with petroleum jelly; or the magneto should be removed completely. Protect flywheel and exposed shafting with preservative.

**Smoky exhaust.** Usually, a smoky exhaust is a sign of trouble. On some engines, the smoking cylinder may be found by an exhaust pyrometer. If the engine has valves at each exhaust port, the smoke-causing cylinder can be located by opening these valves one at a time.

Another method is to shut off the fuel from one cylinder at a time. Don't attempt this if the engine is under a full load; when one cylinder is blocked off, the governor sends additional fuel to all other cylinders, causing even more smoking.

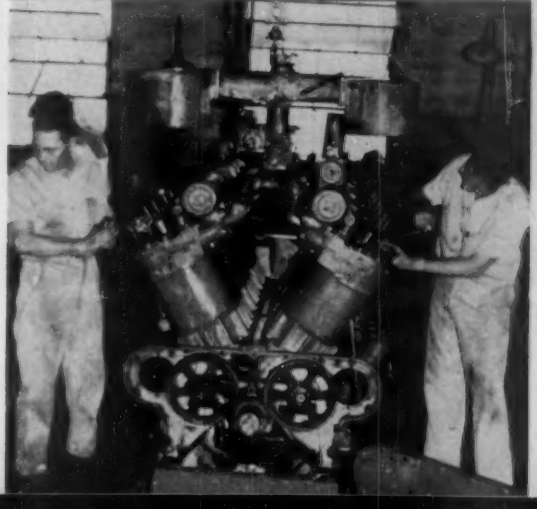
After the smoke-causing cylinder is located, and there is reason to suspect the fuel injector, this injector should be removed. Then, reconnect the injector to the fuel line, turn the engine over slowly, and watch the injector as it spurts fuel into the air. You get a ragged pattern of spray from a bad injector compared to a symmetrical pattern from a good injector. Notice whether the injector cuts off after each injection as it should.

**EACH TIME** that crankcase oil is drained from the engines, the side plate should be removed and all the accumulated trash mopped out before new oil is put in.



**THE CRANKCASE-OIL FILTER** should be serviced each time the oil is changed. Length of time between changes depends on amount of sulfur in the fuel, quality of the oil, and condition of the engine.

**A SHOP OVERHAUL** of the engine is a big expense, but the expense is usually bigger when the engine runs too long after it shows signs of impending failure.



# The rig engine's

## . . . its job is vital. Keep it

**KEEPING CLOSE WATCH** on jacket-water temperature is a must for rig engines. Most of failures not directly a result of wear can be traced at least in part to the cooling system.

**RUST PREVENTATIVES** should be added to the radiator water regularly. Even distilled water would cause corrosion in the engine. Makeup water should be best available and it should be added whenever needed.

**A PRESSURE CAP** on the radiator keeps much of water vapor inside the cooling system. Thus, less harmful makeup water is needed. If used, cap must be kept on tight.

A GREAT MANY of the engine failures not directly the result of normal wear can be traced, at least in part, to the cooling system.

If the cooling system is too small, or if it is not properly cared for, the engine may overheat. The "hot" engine loses power rapidly. And, if the condition isn't corrected, vital engine parts may be damaged or the engine may fail completely.

At the same time, the engine must not be overcooled. When an engine is allowed to run below its normal operating temperature, deposits build up in the cylinders and on the valves. Sludge and acid form in the crankcase. As a result, bearings corrode; cylinder liners, rings, valves, and the like wear rapidly. All these conditions can multiply cost of repairs.

On many rigs, even when new, engine and radiator are purchased separately. Later on, replacement engines and replacement radiators are seldom purchased at the same time. Since the cooling system is so important, the rig owner must be as careful in selecting the replacement radiators as in selecting the engines. And, it's well to remember that about the poorest place on the rig to skimp is on the engine's cooling system.

**Water is big problem.** Most of the trouble arising in the radiator and the rest of the cooling system is a result of the water put into it. The water found at drilling locations is almost always corrosive to some degree. It can be expected to have fine solids suspended in it. Quite often it forms scale. All of these conditions are damaging to every piece of equipment the water contacts.

For that reason, make sure that your radiator water is the best available. If the water is to come from a well drilled on location, the first flow from the well likely is unfit for the engines. Wait until the liquid is clean enough to drink before putting it into the engines.

The water should then be treated with a commercial softener and rust preventer. Even distilled water corrodes an engine if not treated. Corrosive water may support an attack which can eat completely through cylinder liners. Water pumps and cylinder blocks may be corroded beyond repair.

It is important to flush out the rust additive before adding antifreeze to the system. The antifreeze usually has its own rust preventer and this is often not compatible with those used in water alone.

Hard water (that which causes scaling) holds more minerals in solution at low temperatures than at high temperatures. Thus, if a hard water is used in an engine, the minerals precipitate out as the temperature rises. The resulting sludge, when it contacts a hot surface like the wall of the water jacket, sticks and builds up the deposit we call scale.

An accumulation of scale acts as an insulator; it prevents the jacket water from carrying away engine heat. Hot spots develop and engine life is cut short.

Unfortunately, this scaling is quite often hard to recognize until failure is well under way. As a result, it should be standard practice to treat the radiator

# cooling system

## at full efficiency

water regularly even though it may seem unnecessary.

In some areas where available water is especially hard, many rigs have separate water-softening and filtering units. Extra cost of these units is more than paid for by longer engine life.

**Prevent loss of water.** The best water for a radiator is that which has already been there for a long time. Chances are it has already done any damage it can. With this in mind, the rig crew should do whatever is necessary to keep from adding any more water than necessary to the system.

Of course, the radiator should be kept full. There will always be a small loss due to evaporation, but any additional loss is almost certainly the result of a leak. The leak should be located and stopped immediately. Besides the long-range effect of such leaks, they constitute an immediate expense if the system contains antifreeze.

In almost any area it is good practice to use a pressure cap on the radiator. The pressure cap halts the loss of much water vapor and, as a result, less makeup water is needed. Such a cap, of course, does no good if it is loose; the crews should be instructed to see that the caps are always on tight.

**Cleaning the system.** In spite of the best efforts, harmful materials still get into cooling systems. Some of the materials can be removed by draining and flushing at intervals. This should be done at least twice yearly (when adding and draining antifreeze) and may be desirable more often.

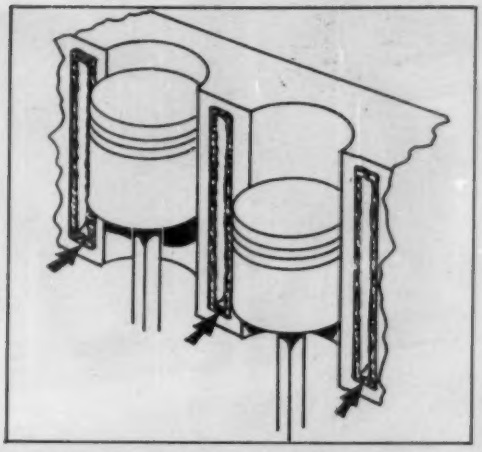
To clean the system, let the engine idle long enough for any "hot spots" to cool down so they will not be damaged when water circulation stops. Or, if the engine is cold, run it long enough to reach operating temperature. Then, drain all water from the system before the suspended material has a chance to settle out. Use all drainage points possible.

After the entire system has emptied, close the drains and refill with a solution of ½ lb. washing soda per gallon of water. Run the engine as usual for 24 hours. Then, drain out the soda solution and refill with clean, treated water.

In extreme cases, acid may be used to remove deposits in the cooling system. Before doing this, check the engine manufacturer for his recommendations.

**Thermostats have two jobs.** Some may think that the thermostats on a drilling engine which runs 24 hours a day are not so important as on an automobile engine which makes only short runs. This is untrue. It is true that the rig-engine thermostat, like the auto-engine thermostat, shortens the warmup period by stopping water flow to the radiator for a time. But, the rig-engine thermostat has important jobs even after the engine reaches normal operating temperature.

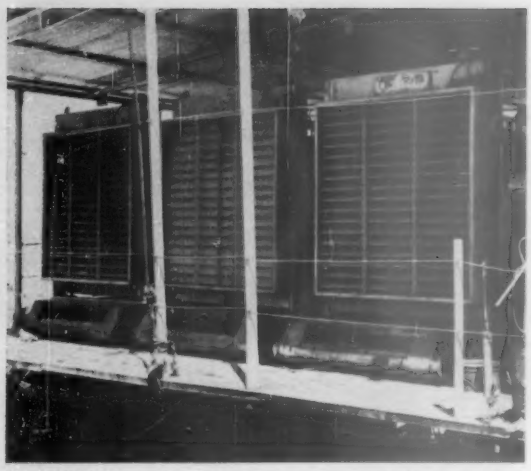
First, the thermostat must continuously open or close slightly to keep engine temperature constant as load on the engine and outside temperature vary. Also, the thermostat acts somewhat as a pressure control within the water jacket. Without this controlled pressure, the water would sometimes boil in hot spots and



**HARD-WATER SCALE** collects on the hot surfaces inside the engine water jacket. This scale is an insulator. As a result, it prevents the jacket water from carrying away engine heat fast enough.

**INDIVIDUAL WATER** softeners and filters for the engine are a worth-while investment in many areas where water is especially hard. If used, they should be serviced regularly.

**WATER TUBES** in radiator cores are easily clogged up by any trash that finds its way into the cooling system. When many tubes are plugged, cooling efficiency falls, the engine runs hot and real damage follows.



**SHUTTERS** in front of radiators open and close to keep engine at constant temperature. These shutters perform much the same service as thermostats but do a more efficient job of keeping engine temperature up in extremely cold weather.

**KEEP RADIATOR HOSES** and connections in good condition. Make sure that the hose connections are tight. Hose material should be good material which does not flake off and clog cooling system.

**TRASH COLLECTING** on the surface of the radiator core should be cleaned off regularly. It interferes with flow of air and, as a result, cuts down cooling efficiency.

form steam pockets. Result could easily be a crack in the block and other forms of damage.

Thus it is evident that the thermostats should never be removed or blocked open in any manner. It is also clear that the thermostats should be checked regularly to make sure that they open and close at their proper temperature. Such a check may be made by taking the thermostats out of the engine, cleaning them thoroughly, and suspending them in a container of water. Then, the container should be heated slowly to operating temperature. A thermometer in the water will show the temperature at which the thermostat opens.

Any which do not open and close at the proper temperature should be discarded; it is not worth while to attempt repair.

In extremely cold weather even the action of thermostats may not be sufficient to keep the engines at operating temperature. If so a portion of the radiator may be covered with canvas or the like. When strips of canvas are used, many recommend that the strips be placed symmetrically (such as one top and one bottom) so that the fan will be evenly loaded.

Many cold-weather rigs have automatic shutters on the radiator to act as a cover. These shutters perform somewhat as a thermostat—opening when temperature is high and closing when it is low. Quite often the thermostats are removed from engines with automatic shutters; some manufacturers, however, recommend that the thermostats be left in.

**Pump and packing.** If the water pump should fail and this go unnoticed, the engine would stop in a matter of minutes; it might be destroyed completely. Complete failure of the water pump is seldom the problem, however. Most often the troubles associated with the water pump are leakage around the shaft and using too much grease or the wrong kind of grease.

When water leaks out around the water-pump shaft, tighten the packing until the leak stops; then back off the packing nut slightly. If packing is too tight, it can bind and score the shaft.

If too much grease is used on the water pump, the excess gets into the jacket water. As this grease moves about the system, it acts as a binder for any particles or rust, scale, dirt, and the like. Such a collection of trash clogs up small openings in the radiator and in the engine itself. The grease-bound material also collects on the metal surfaces and cuts down efficiency of the entire cooling system.

For these reasons, no more grease than necessary should be used. Still, a fear of using too much grease should not prevent the pump from being lubricated regularly with a moderate amount of grease.

Moreover, the grease should not be a type which is cut by water at the high temperature of the engine. Some greases do quite well at ordinary temperatures but are washed away by water at higher temperatures.

Most pumps need repacking occasionally. Any good steam piston-rod packing is satisfactory on most models. When the old packing has been removed, clean the packing box and inspect the pump shaft; even new packing will not prevent leaks on a badly worn shaft.

If the pump shaft must be replaced, it is usually necessary to replace impeller and shaft as a unit.

**Keep sound hoses on engine.** Even the best of modern radiator hoses are trouble spots at times. Usually the problem is no fault of the hose: clamps are not kept tight, or improper fit causes the hose to buckle.

Loose clamps can permit water to leak out or air to be drawn into the cooling system. Air in the system

is a source of real damage—it can support corrosive attack throughout the engine.

If the piece of hose is too long, it tends to buckle and wrinkle. Then the inner lining of the hose can fail, loosening particles which clog up the system.

Also, from time to time, damaging chemicals get into the water; these chemicals may attack the hose, causing rotting, swelling, and flaking of the rubber. Once in the water stream, this hose material may deposit out on water-jacket surfaces, causing the same type of damage as that from hard-water scale and rust.

**Care for radiator.** Pound for pound, the radiator costs more than the engine itself. So, there's a real saving to be made in giving the radiator a reasonable amount of care. It should go without saying that the radiator should be protected during moves so that it is not struck by other equipment. The same is true after the engine is in place and the rig drilling.

If a radiator core develops a leak, it should be repaired immediately. Doing so may save the cost of a new unit since the brass radiator parts always deteriorate quickly in the area of a leak.

Keep the radiator clean both inside and out. By no means should oatmeal, bran, or similar materials be put into the radiator to stop a leak. The material is almost certain to lodge in a thermostat and interfere with its operation. It also plugs the tubes.

Don't spray water on the outside of the radiator to cool the engine; this water can cause a scale that cuts down the cooling capacity of the radiator. Before long, enough of this scale will have built up that the engine can't stay cool without the water spray. Then it's only a short time till even this won't cool the engine.

Also, keep the outside of the radiator clean and dry of oil and the like. Much of the debris that collects on the radiator can be removed by a high-pressure air hose; that which cannot should be taken off with a wire brush.

**Watch replacements.** One way to compare radiator cores is by the number of water tubes and by the number of fins per inch on the tubes. Generally, the more tubes and the more fins, the more heat the radiator can throw off from each square foot of its surface.

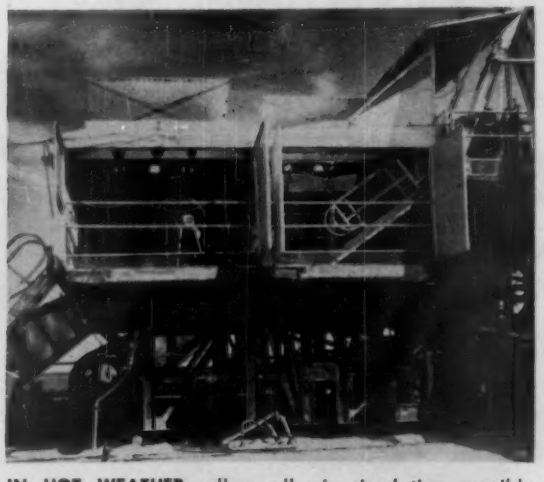
Of course radiator manufacturers can't continue adding tubes and fins without end. Each extra tube and fin is a restriction to the flow of air. Such restrictions may mean that more useful horsepower is wasted in bigger fans. Besides, more trash collects on the surface of radiators with great numbers of tubes and fins; such trash cuts efficiency.

When more water tubes are used, each one must be smaller than before. However, the tubes cannot become so small that water does not flow down through them fast enough. If the tubes restrict water flow, the pump begins to pull a vacuum, thus drawing air into the cooling system; air causes corrosion. The vacuum also allows the water to boil at much lower pressure, causing hot spots in the water jacket.

Some replacement radiator cores may not have a top tank design suited to the amount of water being circulated. With such a tank, there may be so much turbulence that water is lost out of the overflow.

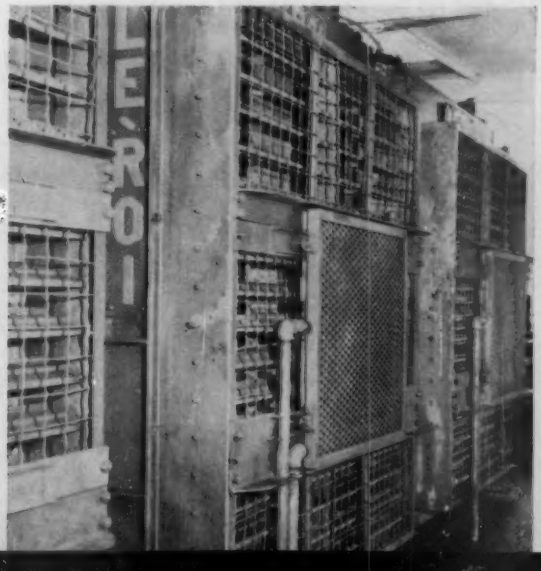
While all these factors are kept in balance on the new engine-radiator package, and while there is some allowance for normal wear and use, there is no room for neglect. First off, it is well to get replacement cores from the manufacturer of the original. If not, make sure that the replacement matches the original in number and size of water tubes and fins. The proper replacement core costs little more than an inadequate one.

**RESULT OF RUNNING WATER** over the outside of the radiator to cool engine is scaled-up fins and tubes like these. Result is poor cooling. Then, even more water must be used. Finally, the core is completely plugged.

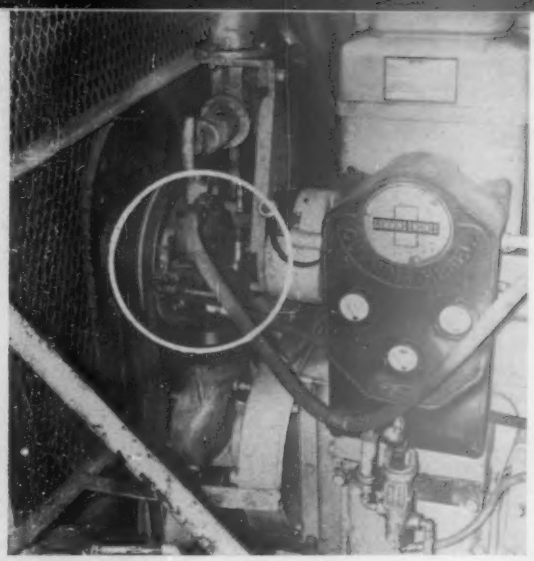


**IN HOT WEATHER,** allow all air circulation possible around the engine. This rig has doors in roof of engine shed to keep air moving. In close quarters, air may recirculate through radiator and cause engine heating.

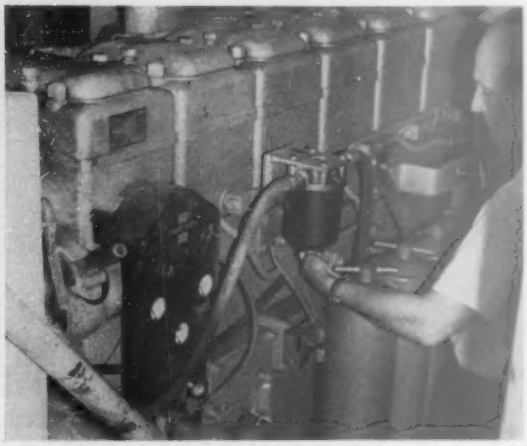
**EXTRA LOAD** on the cooling system is radiator for torque-converter oil. Such additional loads and the need for small size make it important to get replacement cores with sufficient number of tubes and fins.



# FUELS—and fuel-



**CLOSE TOLERANCES** in diesel-fuel injection pump, shown here, and small ports in the injectors make it vital that good quality fuel be used and that it be kept scrupulously clean.



**FUEL FILTER** should be drained daily and the element should be inspected each week and changed if necessary. Be careful when working on equipment downstream of the filter that no trash gets into the system.

**RECIRCULATED FUEL OIL** from the injection pump should be piped back to a tank such as this rather than to the inlet of the injection pump. This prevents any air from becoming entrained in the system.

COST OF FUEL is usually the largest single expense in operating the rig engine. If a poor fuel is used, or if it is not kept clean, it can add even more cost in the form of engine repairs and unnecessary down time.

**Diesel engines.** Three most-important features of a diesel fuel are: its price, its cetane number, and its sulfur content. A high-cetane fuel, like a high-octane gasoline, costs more; but like premium gasolines it burns more smoothly. Some rig engines, like some auto engines, require a high-performance fuel; others operate on the cheaper low-performance fuels.

It should never be necessary to use a fuel containing more than 1% sulfur, and a 1% fuel should never be used when a lower-sulfur fuel is available. In the engine, the sulfur combines with oxygen and water to form highly corrosive acids. When these acid products escape by the pistons to get the crankcase oil, bearings and other vital parts can be eaten away quickly.

Remember that the more sulfur the fuel contains, the more often crankcase oil must be changed to get rid of the acid.

Another point to remember is that a diesel engine's fuel-injection pump and valves are made with very close tolerances. Moreover, the holes in the injector nozzles are quite small. As a result, trash in the fuel quickly abrades, plugs, or corrodes vital parts and interferes with engine operation.

Unfortunately, much of the water and sediment in diesel fuel comes from the supplier's tanks. Thus the rig fuel system must be capable of removing this trash as well as any other material which gets into the fuel on the rig. Drain the fuel tanks regularly to remove water and sediment: clean the tanks occasionally.

Drain off any water or sediment which collects in the engine's fuel filter. Change this filter immediately when it becomes dirty; condition of the filter can usually be gaged from the fuel-pressure gage.

When it is necessary to work on the fuel system, take care that no outside grime gets in. This is especially important when making and breaking connections between the fuel pump and the injectors and between the filter and the fuel pump.

Diesel-engine fuel pumps are not designed to lift fluid higher than a few feet. If called on to lift too far or if high temperature makes the fuel volatile, vapor forms in the lines and makes real trouble. Also, some fuel from the pump is recirculated. For these reasons it is good practice to have a small surge tank close to the engines. This surge tank can be supplied from a main storage tank. If the main tank is elevated, fuel can flow by gravity into the surge tank.

The fuel tank should be large enough that it doesn't need refilling too often. Still it should not be so large that a lot of water condenses in it or the fuel stays inside long enough for gums and resins to form.

Don't use fuel lines which are too small. If they become kinked or partially plugged, they quickly starve the engine. Small lines are most troublesome in cold weather when diesel fuel may tend to thicken and flow less easily.

# handling equipment

A good-quality line is important too. A cheap flexible hose may decompose or flake so that rubber particles are carried to the engine. A carelessly laid metal line may contain rust, pipe-thread dope, and dirt.

**Gas-engine fuels.** While cleanliness of fuel is also important in a gas engine, the problem is not so critical as in diesels. For instance, since LPG is usually clean when delivered and since it is under pressure, there's less chance for foreign matter to get into the system. And when it does get in, the passages through the lines, vaporizers, and carburetor are fairly large and not so easily harmed.

Of course, natural gas as it comes from most field lines carries a lot of fluid and solid trash. To protect the engine from these things, the gas must be processed through a separator or scrubber.

Sour natural gas should not be used in the engine for the same reason high-sulfur diesel fuels should not be used.

Most common of fuel problems on gas engines are these: too little fuel, poorly regulated pressure, bad engine timing, or LPG mixes containing too much butane. Oddly enough it is common for engines to get too little fuel; the cause may be low pressure in the field lines, poor plumbing, or too-small pressure regulators. Or, with LPG, the fuel vaporizers may be too small or not working properly.

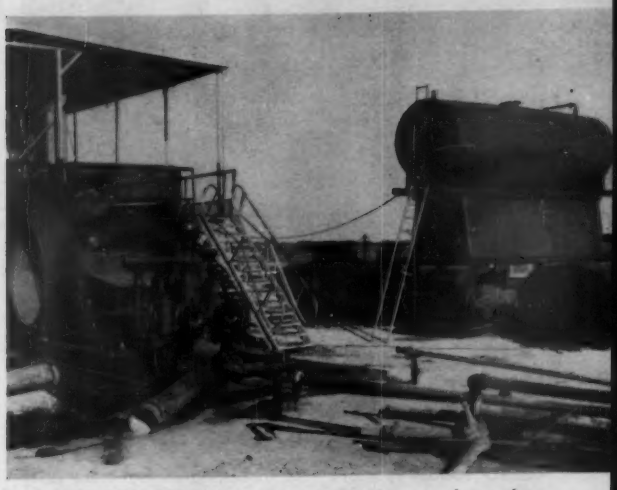
Actually, the problem of too little fuel is worse than it appears on the surface. It means that fuel mixture becomes too lean and that the engine runs hotter. Damage is certain to occur if the situation continues for long. Thus it is important to use properly sized piping and regulators. If they are needed, two LPG vaporizers should be used.

There's a great difference in ignition timing when the engine is set to run its best on natural gas from what it is when set to run on pure propane. Timing is different still when the engine is set to run most efficiently on butane-propane mixes. As a result, an engine timed to run on natural gas may knock badly when run without retiming on an LPG mix.

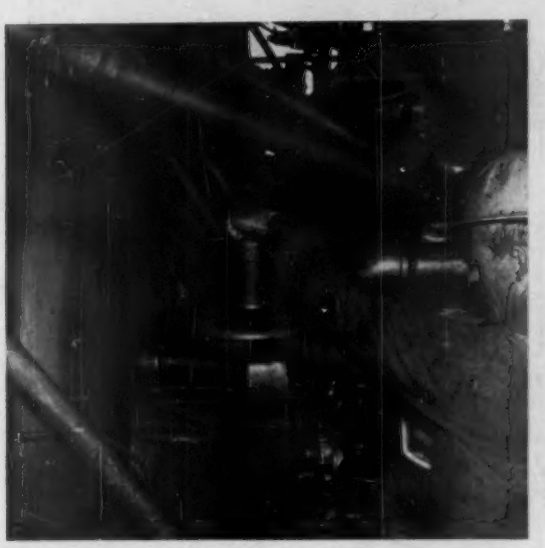
An engine knock is not only irritating because it causes loss of engine power, it is also destructive to the engine. Prolonged operation of a knocking engine can break pistons and piston rings. To prevent knocking and to get maximum engine performance, make sure timing and carburetion are correct when fuels are changed.

Of the gaseous fuels used in rig engines, butane has the lowest octane rating and causes most knock. For this reason, the LPG fuel mix should not contain less than 60% propane. If pure propane is available at a good price and if the rig tanks can handle it, use it instead of the mix.

Here are some other pointers on LPG. Don't take vapors off the top of the tank to run heaters or small engines. This removes the propane so the main engines have to run mostly on butane. Don't fill an LPG tank completely; leave a vapor space so that the gases have room to expand.



**ELEVATED FUEL TANK** keeps gravity flow to tank on the engines. Thus, even on hottest days with volatile fuels, there is no danger of vapor forming in fuel lines.

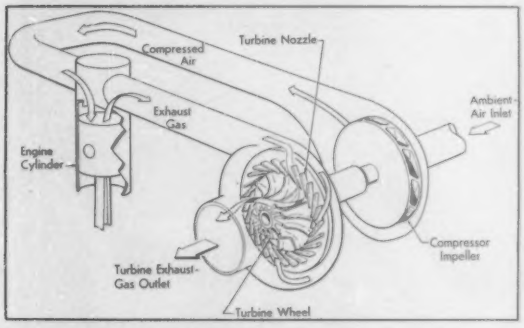


**POOR PRESSURE REGULATION** is one of the most common causes of trouble on gas engines. The regulators, both field and engine, should be checked regularly to see that they pass enough gas at the proper pressure.

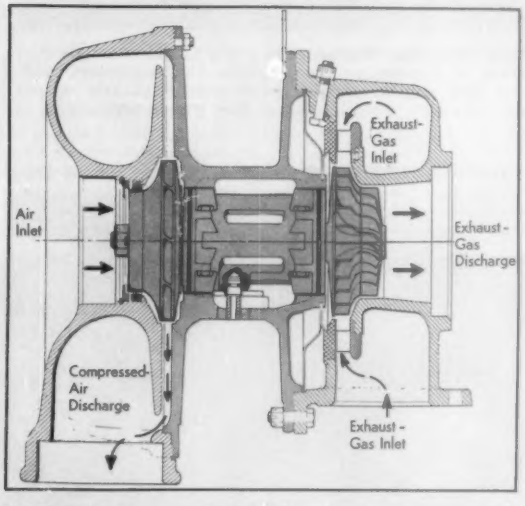
**ADJUSTING CARBURETOR** on gas engines is not the only step to switching from natural gas to LPG. Sometimes, the engine must be retimed as well. This is especially true if the fuel contains a high per cent of butane.

# TURBOCHARGERS

**TURBOCHARGERS** make this three-engine rig more powerful for its weight. By pushing more air into the cylinders of the diesel engine, the turbocharger makes it possible to burn more fuel, increase power.




**EXHAUST-DRIVEN TURBINE,** shown here in simplified form, drives a compressor which puts extra air into cylinders. Turbine puts little back pressure on exhaust so efficiency of engine increases.




**SAME SHAFT** carries both turbine and air compressor. Thus, both turn at same speed. There's no mechanical connection between turbocharger and rest of engine so one cannot ordinarily cause damage to the other.

SUPERCHARGING—cramming more air into the cylinders—is about the only practical way to make a big increase in the efficiency of an engine in good operating condition.

Of course, the sole purpose of the extra air is to make possible burning more fuel. Because of that extra fuel, the same engine can deliver more power.

On drilling rigs, almost all supercharging is done by turbochargers—turbine-driven air blowers. While the turbocharger is driven by the hot exhaust gases from the engine cylinders, it puts little back pressure on the exhaust. As a result, almost all the power derived from the extra fuel is converted into useful work.

Don't confuse the turbocharger on the four-cycle diesel with the scavenger-blower on the two-cycle. The two-cycle blower pushes exhaust gas out with fresh air, but the device cannot ordinarily supercharge the cylinder because exhaust and intake valves are open at the same time. On the other hand, gas engines are not supercharged because fuel mixtures would be hard to regulate and because exhaust temperatures are several hundred degrees higher.

A few rigs have belt-driven superchargers much like the blowers on two-cycle engines. Such mechanically driven superchargers take power directly off the engine shaft—power which could be used on the driven load. As a result, these superchargers don't add as much efficiency as a turbocharger; but they don't have to withstand the punishment of a hot exhaust either.

The exhaust turbine usually kills enough exhaust noises to make a commercial muffler of no benefit. As a result, engine manufacturers recommend that no muffler be used behind the turbocharger so that back pressure is held to the absolute minimum. Also, it is quite important that no long pipes or unusual restrictions be used behind the turbine exhaust.

**Exhaust temperature.** There are several things which can make an engine exhaust run hotter than normal. A cooling system in poor condition, too lean fuel mixture, working at extremely high altitude, or continuous overloading are things which can cause exhaust temperature to rise higher than it should.

**Speeds run high.** There is no mechanical connection between the turbocharger and the other moving parts of the engine proper. For this reason, troubles in other areas can't be blamed on the turbocharger nor do these troubles ordinarily harm it. For the same reason, speed of the turbine isn't determined by engine speed. The turbine is free-running, its speed controlled only by the volume of exhaust gases passing through it. Thus, the output of the turbocharger closely matches the demands of the engine.

Because the turbocharger's air blower is mounted on the same short shaft as the turbine, both run at the same speed. This speed is quite high, sometimes reaching nearly 40,000 r.p.m.

The combination of this high-speed and high-exhaust temperature makes proper care necessary. While the materials used in the turbine are adequate for the temperatures normal for diesel exhaust (about 1,200° F.), the cause should be found immediately if temperature goes higher. Otherwise, the turbine may be overheated and vital parts damaged.

# —their job and care

**Keep clean and tight.** The turbocharger must be treated like any other high-speed device. Obviously, neither the turbine wheel nor the air impeller should be cut, drilled, chipped, or scraped in any way. To do so can upset the balance of these parts and set up vibrations which quickly destroy the machine.

Nor should any foreign material be allowed to collect on the surface of the air impeller. This means that the intake air cleaner must be given regular care.

Occasionally, lubricating oil collects on the air blower. This oil may be from the turbine itself or it may come from a carelessly overfilled air cleaner. Such an oil film on the impeller collects fine dust particles which the air cleaner cannot screen out. The dust is harmful and should be removed periodically by cleaning with a soft rag and solvent. Never clean by scraping, filing, or wire brushing.

There should be no leaks in either the intake air or exhaust-gas system of the turbocharger. Even a small leak can cause a serious loss of engine power. In fact, if the turbocharged engine doesn't seem to be carrying its usual load, the first place to check is the connections between the turbocharger and the intake and exhaust manifolds. Check these connections regularly to make sure they are tight.

**Cool it and oil it.** Remember that the turbocharger is the only part of the engine containing bearings and seals which are subject to exhaust temperature. This fact shows why lubrication and cooling are so important to the turbocharger.

Basically, the same rules apply for lubrication and cooling this device as for other parts of the engine. Water going through a fully loaded turbocharger may pick up 30° F. in temperature; the oil may increase 20° F. If there is a greater temperature rise in either, check to make sure that there is no restriction of flow.

Drain all water from the turbocharger when the engine is shut down in cold weather. Then, when the engine is started up again (or at any other time the engine is started up after a prolonged shutdown), check to make certain that oil and water circulation is free.

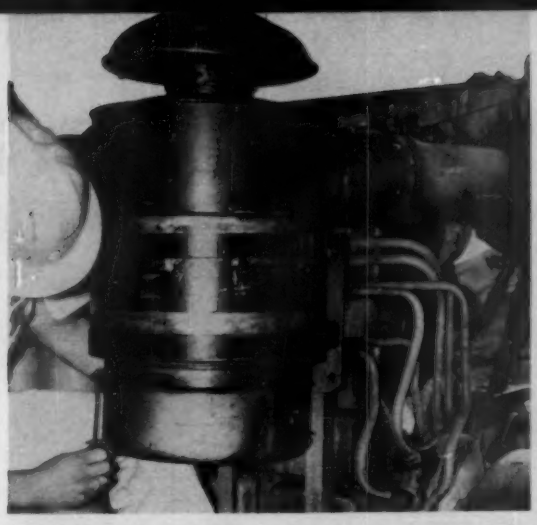
After a turbocharged engine has been under load, it should be idled for at least 5 or 10 minutes before it is shut down. This allows the oil and water circulation to continue through the turbocharger and other parts until any potential hot spots have cooled down. If the engine isn't idled before shutdown, bearings in the turbocharger may seize or oil seals may loosen.

Do not relocate the water lines or change them out for lines of a different diameter. To do so invites poor water circulation and overheating of the unit.

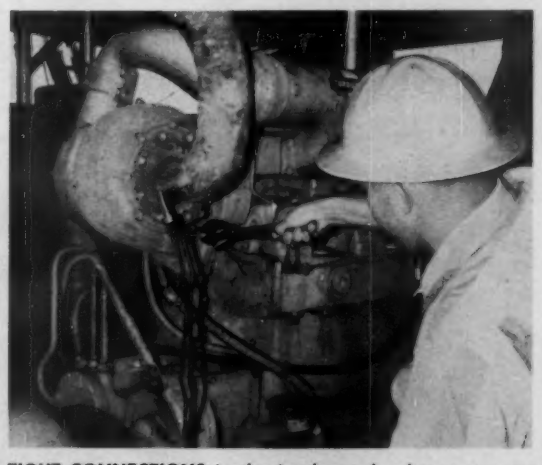
Make certain that the air-intake cleaner is not overfilled with oil; the excess can easily spill over and collect on the impeller. Such an oily coating collects dust and other trash which eventually cuts air-blower efficiency.

However, do not become alarmed if some models show a slight leakage of turbocharger lubricating oil at idling speed. These models use air pressure on the oil-ring seals. At idling speeds the pressure in the blown-air system is lower and oil may escape past the seals.

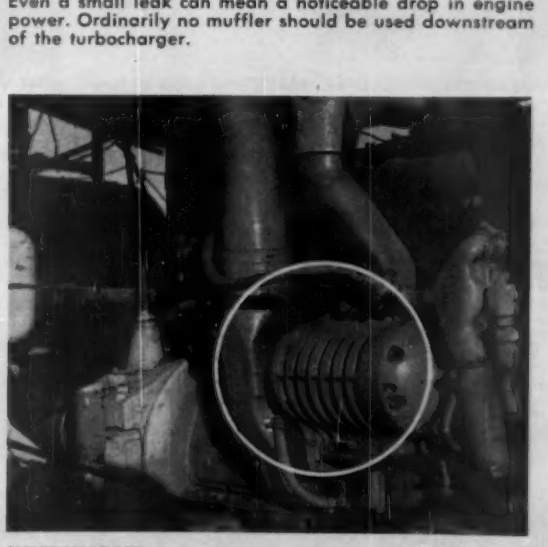
On new and replacement turbochargers, it is wise to use a preoiling pump to make sure that bearings are not damaged when the engine is started and before regular oil circulation is established.



**REGULAR CARE** of the intake air cleaner is a must for the turbocharger. Since the air compressor turns at high speed, large amounts of foreign material could upset its balance and interfere with operation.



**TIGHT CONNECTIONS** in the intake and exhaust systems are necessary if the turbocharger is to work properly. Even a small leak can mean a noticeable drop in engine power. Ordinarily no muffler should be used downstream of the turbocharger.



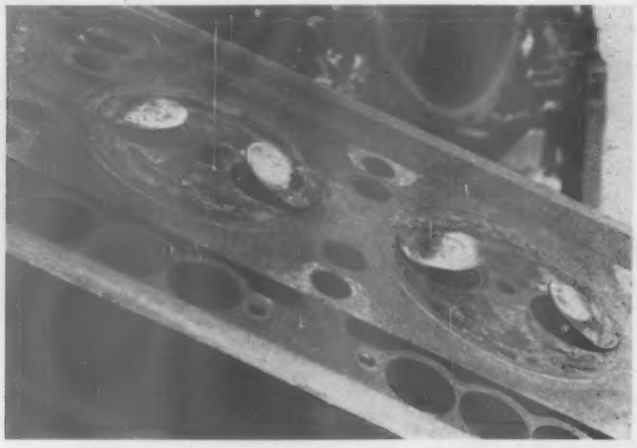
**SUPERCHARGER** serves same purpose as turbocharger but is run by mechanical drive from the engine crankshaft. While supercharger boosts engine efficiency, increase is not as great as with turbocharger.

# Typical results of rig-engine neglect

**RODS THROUGH** block of rig engine are result of poor lubrication. Running under heavy load, bearings got progressively hotter and finally seized completely. Remedy: Keeping proper level of good lubricating oil and changing it regularly.

**CRACK IN CYLINDER HEAD** between valve ports is result of poor cooling. Water passages in the area are fouled by scale so that a hot spot developed. Remedy: use good make-up water and treat it for scaling.

**COMPLETELY WORN BEARINGS** are result of fuel dilution and improper lubrication. Unburned fuel escaping past piston rings diluted fuel so that bearings had weak oil film; then oil wasn't changed when necessary. Remedy: Prevent fuel dilution and change oil when necessary.



**BENT VALVES** are consequence of overspeeding. Engine had no overspeed control and the governor was in poor condition from lack of service. Remedy: regular servicing of engine controls.

**SCORED PISTONS** are result of poor lubrication when the engine was loaded too heavily while cold. Oil film on cylinder walls was washed off by unburned fuel. Remedy: let engine warm up for several minutes before applying load.

**BROKEN CYLINDER LINER** is caused by overheating of the engine and collection of trash in liner area. Remedy: use good makeup water and give regular care to the cooling system so it keeps engine temperature down.

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# How Humble plans for minimum drilling costs

## Typical Minimum-Cost

| Depth, ft. | Bit type— | 0 Wt. M. lb. | 0 Rty. r.p.m. | 2 Wt. M. lb. | 2 Rty. r.p.m. |
|---|---|---|---|---|---|
| 7,000 to 9,000 | Soft formation | 45 | 70 | 50 | 70 |
| 9,000 to 10,000 | Medium formation | 45 | 60 | 50 | 60 |
| 10,000 to 11,000 | Med.-hard formation | 45 | 50 | 50 | 50 |

*At any time that your experience tells you that something

BY ED McGHEE, Drilling Editor,
and CARL HOOT, Journal Photographer

NOT SINCE the jet bit was introduced 15 years ago has the drilling industry been so absorbed in a new development as it has in the idea of optimum drilling practices.

A real pioneer in optimum drilling has been Humble Oil & Refining Co. Humble calls its system "minimum-cost drilling" or MCD. Regularly, Humble's MCD programs have speeded penetration and made important cuts in drilling cost.

With such results, it is no surprise that the company has speedily set up a routine in which MCD is used on all wells where it can be applied practically.

This is the story of how Humble's routine works. It is not the same routine other companies may adopt to apply the principles of optimum drilling, but it has much to recommend it.

**What is MCD?** Optimum drilling or minimum-cost drilling uses bit weights and rotary speeds which have been scientifically calculated. Object of the calculations: Find the combinations of weight and speed which drill the hole at the lowest possible cost. Why are scientific calculations necessary? Because no human brain can possibly juggle simultaneously all the many things which affect the cost of a foot of hole.

Some of the questions which must be answered to fix drilling cost are these: How fast does the bit drill when sharp? How fast when dull? How rapidly does it become dull? How can it be run to stay sharp longer? How fast do bearings wear in one mud? How fast in another? How fast does the bit drill at a high weight? How fast at a low weight? How fast does it drill at high rotary speed? How fast at low speed? How much does a round trip cost? How much does the bit cost?

It is possible to calculate all these things out by simple manual methods. But it would take hundreds

## Here's a typical well to show how MCD program works

. . . a picture sequence

1 In advance of spud date, executives of Humble's Gulf Coast area confer on a proposed drilling location. J. W. Winfrey, area production engineer; G. C. Nicklow, area operations superintendent; H. M. Krause, area engineering coordinator, and T. J. Fuson, also an area operations superintendent, specify an MCD program for the well. Then . . .

## Drilling Program for the Gulf Coast Well

| HOUR OF BIT RUN | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | | 6 | | 8 | | 10 | | 12 | | 14 | | 16 | | |
| Wt. M. lb. | Rty. r.p.m. | Wt. M. lb. | Rty. r.p.m. | Wt. M. lb. | Rty. r.p.m. | Wt. M. lb. | Rty. r.p.m. | Wt. M. lb. | Rty. r.p.m. | Wt. M. lb. | Rty. r.pm. | Wt. M. lb. | Rty. r.p.m. | |
| 54 | 70 | 58 | 70 | 62 | 70 | 66 | 70 | 70 | 70 | 74 | 70 | 77 | 70 | Pull first bit at 14 hours and inspect. If bearings are OK, run remaining bits 16 hours.* |
| 54 | 60 | 58 | 60 | 62 | 60 | 66 | 60 | 70 | 60 | 74 | 60 | 77 | 60 | Pull first bit at 14 hours and inspect. If bearings are OK, run remaining 16 hours.* |
| 54 | 50 | 58 | 50 | 62 | 50 | 66 | 50 | 70 | 50 | 74 | 50 | 77 | 50 | Pull first bit at 14 hours and inspect. If bearings are OK, run remaining bits 16 hours.* |

is wrong with the bit, it should be pulled regardless of the hour of the bit run.

of hours. Instead, Humble uses a medium-size digital computer to grind out a complete MCD schedule in comparatively short time. The company stresses that its calculations are not infallible and are no substitute for the driller's experience.

Other companies plan on using sets of graphs to figure optimum weights and speeds. These graphs, or curves, would be similar to those used to analyze the rig's hydraulic system. It is interesting that Humble also calculates its hydraulic programs on the electronic computer.

**What the driller gets.** When an MCD program has been set up for a particular well, the weights and speeds recommended are set out in table form. This table shows the weight and speed to use during the first hour, the weight and speed for the second hour, and so on till the time the bit should be pulled.

The driller follows this program as long as all goes well. But if his judgment tells him the bit should be pulled before the program calls for it, he must rely on his judgment.

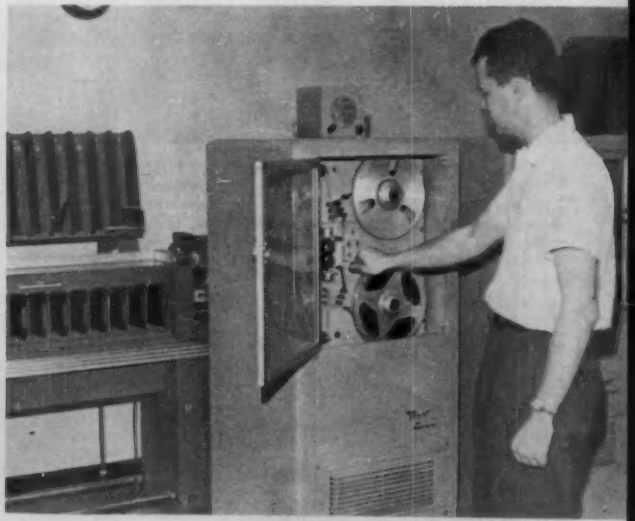
Or the program may be modified if some failure on the rig makes it necessary. For instance, the MCD program assumes hydraulics are optimum. If they are not because of pump or engine trouble, the weight and speed probably must be changed; this is an on-the-spot decision for the driller and field superintendents.

On the Gulf Coast, the MCD schedule doesn't take effect till the hole has reached about 7,000 ft. Above this point, drilling speed is limited by the time it takes to make new connections. Thus, the MCD has no advantage until the well gets deep enough for connection time to be less important.

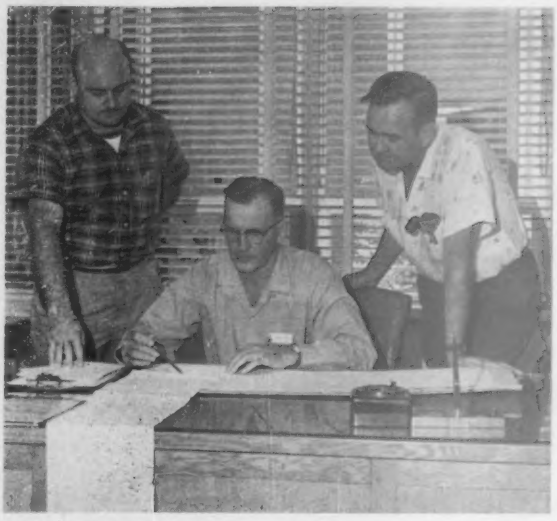
In hard-rock areas, the calculated weights and speeds are used almost immediately below surface pipe.

*(Continued on next page)*

2 Area Drilling Engineer James L. Foster prepares a drilling schedule. With help from men in the well's district, Lee outlines the hole size, casing program, total depth, and rig which will drill the well. Then, at his request . . .



3 The production department's petroleum-engineering computer group prepares a program. Computation, being set up here by Petroleum Engineer N. L. Martin, is done on medium-size digital computer. Results are sent to district production offices in Baytown where . . .



4 District production men examine the proposed MCD program. Drilling Engineer William B. Tom; District Superintendent R. H. Ussery, and District Production Engineer Wade L. Haynes look over the recommendations. From this scrutiny, . . .

5 The MCD program then goes to the rig. Location is a 11,000-ft. wildcat in Galveston Bay. Humble's No. 34 rig is a veteran steam unit and the MCD program is set up specifically for it. In the driller's office, . . .

6 Evening Driller A. B. Lewis and Tool Pusher F. J. Sample discuss the MCD schedule to see if any changes will be necessary to compensate for rig problems not previously considered. Since the rig crew has the entire drilling operation to consider, they have final control. Everything seems to be in order, so . . .

7 Driller Lewis begins the bit run. Weight starts low and continues to increase throughout the run. A driller must be ready to act if trouble develops. Since things are going smoothly,

8 Rotary speed which started out quite slowly is gradually speeded up as the MCD program recommends. Starting at low speed and at low weight keeps bits teeth sharp longer. As teeth dull, weight and speed increase to keep drilling rate up. When the bit has drilled the last foot it can at minimum cost, . . .

9 Time has arrived to pull out of the hole and put on a fresh bit. Most bit runs are longer in feet but shorter in hours under MCD programs. However, idea is not to get every possible foot out of a bit, but to pull it whenever the next foot could be drilled cheaper by a new, sharp bit. Because the MCD program depends on good hydraulics, . . .

10 Rig 34's pumps are often compounded to get good jet velocities and circulating rates. Should one of the pumps go out of service while drilling, the MCD program would be modified so that the bit doesn't ball up. While this well is finished, it isn't forgotten, because, . . .

11 Research engineers examine records. Here, Charles W. Hill, George H. Bruce, and R. H. Friedman plot how to improve MCD programs.

DRILLING TIP

## Gooseneck simplifies mud-tank piping

ONE CONTRACTOR makes his mud tanks without outlets and then runs a line up over the top of the mud pumps. This makes it easy to hook them up and easy to raise or lower the lower end of the pipe to get the mud at the proper level in the tank.

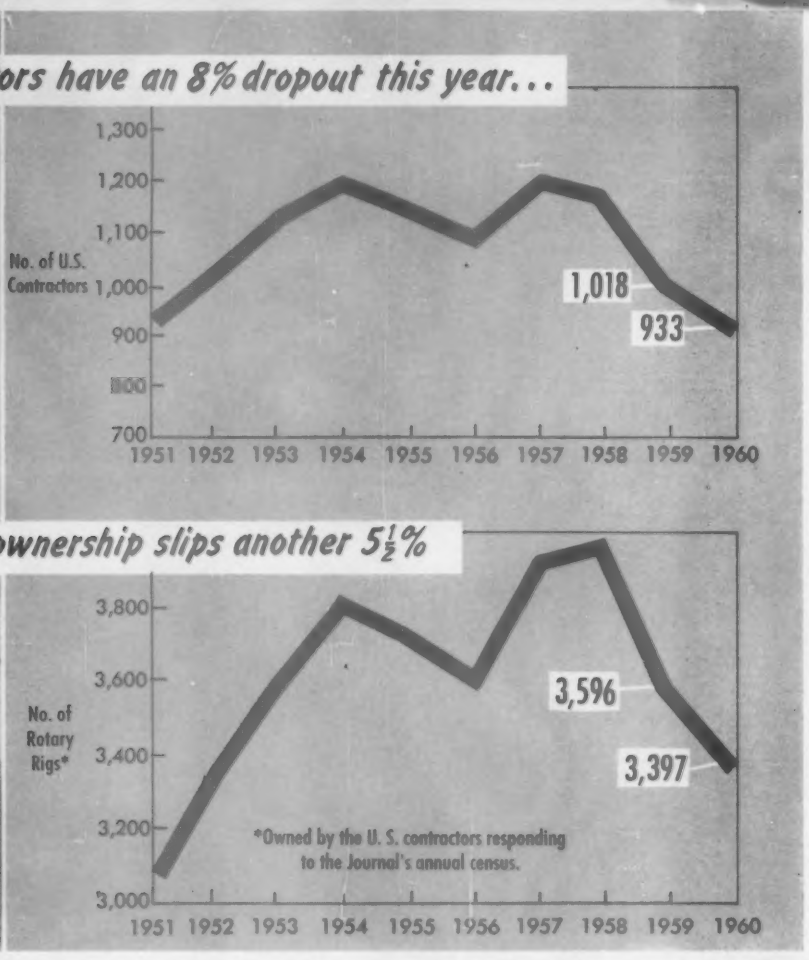
## BOOK

CONSERVATION OF OIL AND GAS, A LEGAL HISTORY 1948-1958. Edited by Robert E. Sullivan. Published by American Bar Association, 1155 East Sixtieth Street, Chicago 37. 351 pp. $5.

This volume is an analysis of the significant conservation legislation, administrative regulations, and judicial decisions affecting the production of oil and gas during the decade 1948-58.

Thirty-seven states and the activities of the federal Government in the field of oil and gas conservation are treated in detail. Extracts of conservation orders treating such things as flaring of casing-head gas, the establishment of minimum prices at the well-head for natural gas, the trend toward wider initial spacing of wells, examples of voluntary and compulsory plans for the unit operation of oil pools and water floods to stimulate secondary recovery of oil, and their relation to the allocation of production according to market demand, are set forth in detail.

Conservation activities in the several states were written by Robert E. Sullivan. Other selections deal with significant developments in conservation, by Robert E. Hardwicke; the activities of the Interstate Oil Compact Commission, by Earl Foster, and conservation in the federal Government, by Northcutt Ely.




# More U. S. contractors throw in the sponge

• New Journal census shows that since 1957 the number of rotary-drilling firms has plunged 23.5%. In the same period, the rig-ownership has slipped more than 13.5%. The biggest companies now own a greater share of the rigs.

A JOURNAL SURVEY

BY ROBERT B. BIZAL
Editorial Research

ANOTHER SIGN of the drilling times, in addition to fewer domestic well completions this year, is the continuing trend toward fewer rotary-drilling contracting firms in the U. S.

Last year, the Journal's annual census showed 1,018 drilling contracting firms doing business in the U. S. In 1960, this had dropped to only 933.

This is about 8% below last year, and a very significant 23.5% below the peak year of 1957 (see chart).

The 933 contracting firms currently

SIZES OF U. S. CONTRACTORS AND CHANGES IN RIG OWNERSHIP SINCE 1957

| Sizes of companies— | No. of contractors in each category 1957 | 1960 | Change | Total rigs owned by group 1957 | 1960 | Change | Per cent of total rigs owned 1957 | 1960 |
|---|---|---|---|---|---|---|---|---|
| 20 or more rigs | 12 | 13 | + 1 | 405 | 501 | + 96 | 10.3% | 14.8% |
| 10 to 19 rigs | 38 | 30 | − 8 | 474 | 401 | − 73 | 12.0% | 11.8% |
| 6 to 9 rigs | 100 | 89 | − 11 | 690 | 609 | − 81 | 17.5% | 17.9% |
| 3 to 5 rigs | 372 | 290 | − 82 | 1,370 | 1,100 | −270 | 34.8% | 32.4% |
| 1 or 2 rigs | 697 | 511 | −186 | 998 | 786 | −212 | 25.4% | 23.1% |
| Totals | 1,219 | 933 | | 3,937 | 3,397 | | 100.0% | 100.0% |

# "It's no surprise the 1960 Journal census shows fewer contractors and rigs."

**HOME OFFICES OF U. S. DRILLING CONTRACTORS IN 1960**

| State and area— | No. of contractors | No. of rigs |
|---|---|---|
| **California** | | |
| Bakersfield | 19 | 49 |
| Los Angeles-Long Beach | 31 | 178 |
| Others | 3 | 5 |
| Total | 53 | 232 |
| **Illinois** | | |
| Various locations | 54 | 109 |
| **Kansas** | | |
| Wichita | 43 | 108 |
| Others | 36 | 72 |
| Total | 79 | 180 |
| **Louisiana** | | |
| New Orleans | 11 | 39 |
| Shreveport | 26 | 119 |
| Others | 27 | 81 |
| Total | 64 | 239 |
| **Oklahoma** | | |
| Oklahoma City | 36 | 140 |
| Tulsa | 59 | 500 |
| Others | 59 | 176 |
| Total | 154 | 816 |
| **Rocky Mountain** | | |
| Denver | 29 | 121 |
| Others* | 50 | 158 |
| Total | 79 | 279 |
| **Texas** | | |
| Abilene | 30 | 88 |
| Albany-Breckenridge-Graham-Jacksboro | 14 | 31 |
| Alice | 13 | 35 |
| Amarillo-Borger-Pampa | 17 | 54 |
| Corpus Christi | 15 | 41 |
| Fort Worth-Dallas | 59 | 260 |
| Houston | 54 | 214 |
| Kilgore-Longview-Tyler | 17 | 118 |
| Midland-Odessa | 35 | 194 |
| San Antonio | 14 | 39 |
| Wichita Falls | 62 | 186 |
| Others | 65 | 163 |
| Total | 396 | 1,423 |
| Other States | 55 | 119 |
| **TOTAL U. S.** | **933** | **3,397** |

*Includes Colorado, Idaho, Montana, Nebraska, New Mexico, North Dakota, South Dakota, Utah, and Wyoming.

**CONTROL POINTS OF CONTRACTORS IN CANADA**

| Province and city | No. of contractors | No. of rigs |
|---|---|---|
| **Alberta** | | |
| Calgary | 42 | 276 |
| Edmonton | 11 | 40 |
| Other | 1 | 1 |
| **Ontario** | 1 | 1 |
| **Saskatchewan** | 1 | 2 |
| **TOTAL** | **56** | **320** |

in business reported ownership of only 3,397 rotary rigs, compared with 1,018 firms owning 3,596 rigs in 1959. The peak rig-ownership year was 1958 when 1,187 contractors owned 3,981 rotaries.

The Journal census is confined to contractors and doesn't reflect rigs owned by producers. Nor do the figures involve cable tools. Actually, 131 of the contractors surveyed this year own 279 cable-tool rigs. Last year, 135 contractors reported ownership of only 230 cable tools.

### Big vs. Smaller Firms

In recent years, the trend has been toward concentration of rig ownership in the largest firms—those owning 20 or more rigs.

In 1957, there were 12 companies in this category, owning 405 rigs, or 10.3% of total rig ownership of the companies surveyed. By 1959, the number of companies in this class increased to 13, owning 488 rigs, or 13.5% of the total. In 1960, there were 13 of the larger firms, owning 501 rigs, or 14.8% of the total.

The percentage of rigs owned by smaller firms has decreased. For example, in 1957, there were 697 companies that owned only 1 or 2 rigs, compared with 511 such companies in 1960.

In 1957, the one-and-two-rig companies owned 25.4% of the total number of rigs. They now own 23.1% of the total (see table).

Fewer drilling-contracting firms also mean fewer employes. The peak employment year was in 1957 when the 1,219 contractors had a payroll of more than 64,600. This year, the 933 companies reported a payroll of not quite 49,500.

Here is a look at the tool-pusher count. In 1957 there were 3,438 tool pushers employed by the rotary contractors. This dropped to 2,971 by 1959. Now there are 2,448.

### U. S. Activity Down, Foreign Up

It's no surprise the 1960 Journal census reflects fewer U. S. contractors with fewer rigs.

Through September 3, 1960, domestic well completions in 1960 totaled 30,188, compared with 34,047 for the same period last year. This is a 11% decrease.

The average number of active rigs was down to 1,739 for the first half of 1960, compared with 2,017 for the same period in 1959 (OGJ, July 25, p. 158).

There is little change in the rig count in Canada, although the number of Canadian contractors has decreased considerably since 1957.

For example, in 1957, the Journal census showed 77 contractors owning 326 rigs. The 1960 census shows only 56 contractors owning almost the same number of rigs, or 320.

Here is a glance at the 1960 well-completion count in Canada. As of September 3, operators in western Canada had completed 1,570 wells, or 119 fewer than the 1,689 completions for the same period last year.

Canadian rotary-rig activity averaged 180 the first half of 1960, up slightly from the 172 for the comparative period in 1959, due to more drilling in deeper areas.

The latest world-wide Journal survey on foreign rig activity showed 842 rigs making hole in the free world outside the U. S. and Canada at mid-year, a near-record level (OGJ, June 27, p. 97). This compares with 824 active rotaries counted by the Journal survey of August 1959.

### Air Drilling Advances

Air drilling is assuming more and more importance in rotary-drilling operations. The extent to which this technique is used is indicated by the fact that 110 U. S. contractors reported they now do air drilling. Seventy-nine of the contractors own 249 air compressors, and 68 contractors lease compressors as needed. The overlap is occasioned by the fact that some contractors own compressors for basic requirements and lease additional compressors when required.

Canadian contractors are also using this drilling technique. Ten contractors reported air-drilling operations. Six contractors said they own 14 compressors, and 6 contractors lease compressors as needed.

(Copies of the complete 1960 U. S. and Canada drilling-contractor report may be obtained free of charge by writing Industry Census Department, The Oil and Gas Journal, Box 1260, Tulsa, Okla.)

*When performance counts–*

# PUT YOUR TRUST IN TORRINGTON THRUST BEARINGS

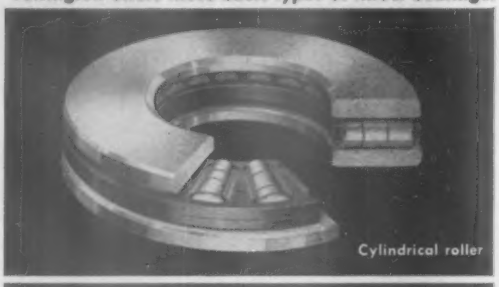
Whatever your performance requirements, there's a Torrington Thrust Bearing precision engineered to meet your needs.

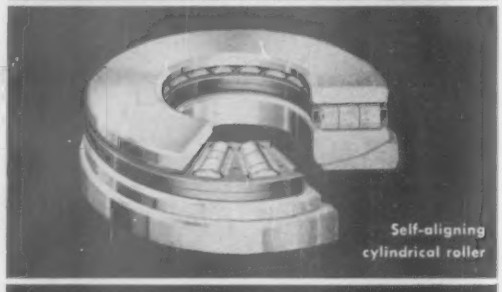
Cylindrical, self-aligning cylindrical, tapered . . . grooved race ball, angular contact ball or needle thrust –all are designed and manufactured to the highest Torrington standards for performance, reliability and long trouble-free service life.

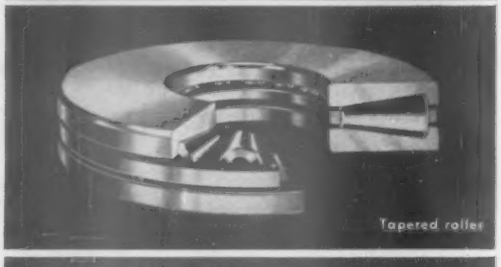
From the smallest to the largest–for power tools or giant radar installations–Torrington Thrust Bearings have the same unmatched precision quality built into every Torrington product. Depending on specific types and applications, they are available with a choice of bronze, steel or phenolic retainers.

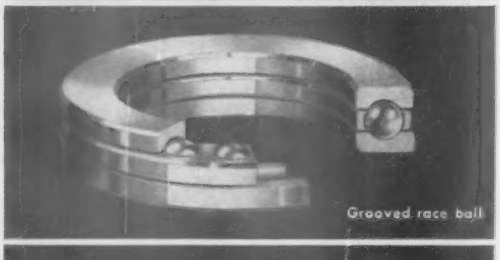
Whether your thrust application calls for a standard bearing or one specially designed to meet unique conditions, you can rely on Torrington for a bearing that's exactly right for the job. Contact Torrington–designers, engineers and manufacturers of every basic type of anti-friction bearing.

**Torrington offers these basic types of thrust bearings.**

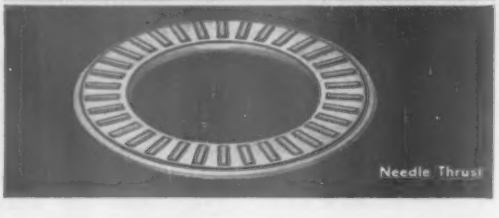

Cylindrical roller


Self-aligning cylindrical roller


Tapered roller


Grooved race ball

Angular contact ball

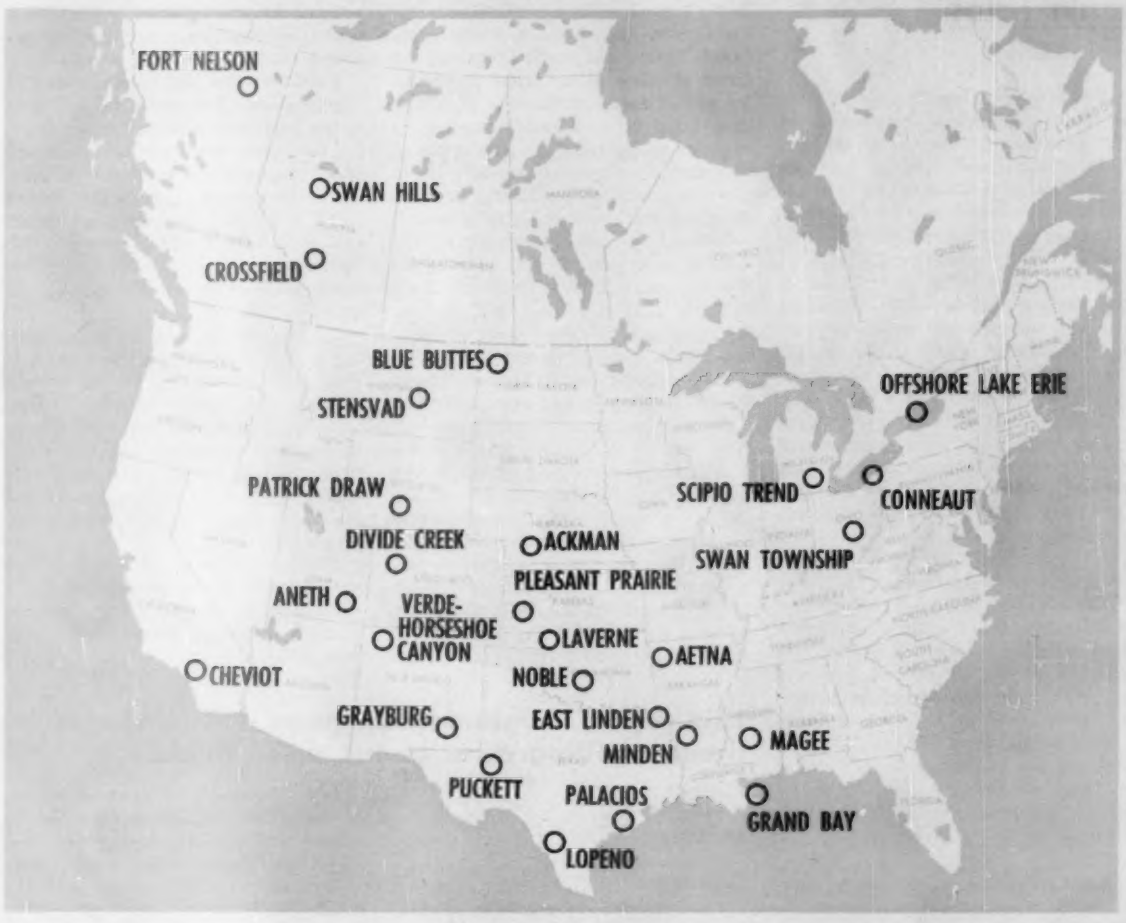

Needle Thrust

*progress through precision*

**THE TORRINGTON COMPANY**

**TORRINGTON BEARINGS**

South Bend 21, Indiana, Torrington, Conn.




Old-timers repeat, new areas abound,
and costs grow more critical, as shown in this . . .

# Active-fields drilling report

BY PETER B. BIKE
Journal Staff

"WATCH THE COSTS" may well be the byword for drilling operations this year. No matter how you look at it, 1960 will hardly be referred to as a stellar drilling year. Each year a few familiar names are among the missing and yet some of the contractors are showing notable progress in total number of rigs running.

The reason is simple—it just costs more to do business than it used to. Efficiency is stressed more than ever. Some firms are bigger and better. Others have taken a beating. The contractors have been hit by a wave of merger fever that has already permeated operating firms. There is a prevalent "watch and wait" trend in this election year prior to the outcome in November. The policies of the newly elected administration will be of vital importance to all American businessmen. (See OGJ, July 18, 1960, p. 62.) Come what may, the experts suggest this: Don't expect instant relief, nor a booming last quarter.

To help analyze the costs of the representative active drilling areas in North America, The Oil and Gas Journal presents its annual review. Average conditions were sought in the data provided by the nearly 200 firms which were polled. Cooperation was excellent.

**Fast pace.** Kentucky continues its fast pace of drilling despite a noted lack of publicity that the area enjoyed last year. Sites are more selective and the search becomes more methodical. State regulations have been enacted with an eye toward conservation. Although the cable tools still predominate, there is an increased tendency to use more small rotaries in Central Kentucky and in the Appalachian region.

The shallow depth, long the most enticing single factor, is giving way to reserve considerations which will determine future spacing patterns. Pays vary from 250 to 600 ft. and a dry hole costs from $2,500 to $4,000. A completed well will run from $5,000

## ACTIVE FIELDS

to $10,000. Not much change from last year's figures are apparent in the over-all picture. The wells are still being acidized and footage rates are $3.75. The pays are 10 to 25 ft. thick. The play has overflowed into northern Tennessee and the Kentucky discovery success ratio is still encouraging.

The Empire Abo reef trend in southeastern New Mexico is humming with rigs. Kicked off by Pan American Petroleum Corp.'s initial successes, this area is bustling with activity. What started off as a quiet drilling campaign in 1951 near Lovington, has exploded into a full-scale search in Lea and Eddy counties, following the early-year completion of the Carper 1-A Federal between the Lovington production and the Empire Abo reef oil found in 1958 by Pan Am, 50 miles west of Lovington.

The Abo formation has reef sections of 850 to 1,000 ft. thick at depths from 4,500 to 8,300 ft. Reserves vary from 10,000 to 25,000 bbl. per acre at Empire and Lovington, respectively. Well costs in both areas range from a minimum of $85,000 to $140,000 and are usually flowing. Drilling problems are few and completions are relatively simple. (See OGJ, July 11, 1960, p. 66.)

**Alaska.** Alaska continues to draw much interest with a single area—Swanson River on the Kenai Peninsula—classified as the only active development area. Probably this will cease to be the only area which will be active. Any one of several wildcat plays could turn into exploitation programs. Just east of Umiat oil and Gubik gas fields, in the Umiat basin of northern Alaska, there have been several large tracts leased to private firms. The proved reserves found by the U. S. Navy at 4 Petroleum Reserve, evidenced by the two existing fields, will undoubtedly be expanded once drilling density is increased.

Some areas just never seem to give up. During the past 2 years Ashtabula County, Ohio, in the state's extreme northeast corner, beckoned to all comers, flounting its 72% success ratio. Typically the land of the standard tools, this activity hasn't waned much. Along with the Appalachian region, Lake Erie offshore drilling, Central Ohio, and the Scipio Trend of South Central Michigan have continued a steady pace which occasionally flare up with bursts of sporadic drilling.

**Choice spots.** There are other sectors that just have the reputation for being a good place to drill. Northwest Oklahoma, the Four Corners area, South Texas, and South Louisiana are listed as a few of the prime prospects. In any of these locales, the high success ratio is inducement enough to warrant the investment. The depth of the targets may vary greatly from state to state, or in different portions of the same province. East Texas is a classic example of presenting the option: How deep do you want to go? Pecos County in West Texas is a deep-driller's challenge, and not without its problems. If one were to relate the depth directly to the reserves in place, perhaps South Louisiana with its numerous pays and extremely thick section is the place to go. Expensive? Yes! But most certainly worth while.

Current prima donna of the Rocky Mountains is Southeast Lisbon in San Miguel County, Colorado. Pure Oil Co. is enjoying a brisk play in this area. Wyoming is a continual provider of good fields. Some of the glitter is gone from the Williston basin, as seen by some of the firms which have pulled in their horns. It's a good bet that all the big ones haven't been found in Williston, and another go-round could be in the offing.

California has had several cycles of rejuvenation. Following the gas hunt in the Sacramento Valley which started last year, the activity continues. More emphasis has been put on drilling in the southern part of the Golden State in the heavily populated urban Los Angeles. Drilling between the buildings presents special problems ranging from town-lot leasing to soundproofing of rigs.

Canada drilling activity is continuing at a moderate rate. There are vast new areas which remain to be explored. The Arctic Islands, Yukon, and the Northwest Territories have barely been scratched. A few good strikes could result in tremendous drilling programs. Drilling has fanned out north from Alberta, still the hub of activity.

Bad as the year has been, there's always some encouragement. It could get worse, but there's always the possibility of things picking up—after November.

**This report, beginning on page 159, includes timely drilling data about these fields . . .**

**ALASKA**
Swanson River.

**ARKANSAS**
Aetna, Stamps Area.

**CALIFORNIA**
Beehive Bend, Beverly Hills, Cheviot, North Tejon, Oxnard, Ventura Avenue, Wilmington.

**COLORADO**
Divide Creek, McClave, Southeast Lisbon.

**KANSAS**
Pleasant Prairie.

**LOUISIANA**
Bastian Bay, Block 24 Grand Bay, Lake Washington, Minden, Weeks Island.

**MICHIGAN**
Scipio Trend.

**MISSISSIPPI**
Bryan, Magee, Raleigh.

**MONTANA**
Cabin Creek, Dwyer, Stensvad, Sumatra.

**NEBRASKA**
Ackman, Reiher.

**NEW MEXICO**
Blanco, Grayburg, Langlie - Mattix, Maljamar, Verde-Horseshoe Canyon, Horseshoe Canyon.

**NORTH DAKOTA**
Blue Buttes, Glenburn, Rival.

**OHIO**
Conneaut, Swan Township.

**OKLAHOMA**
Cherokee Trend, Enville, Hugoton, Laverne Area, Luther Hill, Mocane, Moore Area, Noble Area, North Buffalo, Northeast Cheyenne Valley, North Okarche, Payne Area, Southeast Marietta, Shattuck Area, Sho-Vel-Tum, Southwest Kingfisher, Valley Center.

**EAST TEXAS**
East Linden, Haynes, New Hope, Southeast Fruitville, Wright Mountain.

**NORTH TEXAS**
Boonesville, New Mag—Oil Creek.

**SOUTH TEXAS**
Lopeno, Palacios Area, Person, Port Arthur-Port Acres, Red Fish Reef-South, Theuvenins Creek.

**WEST TEXAS**
Bakke, Dune, Foster, Fullerton, Goldsmith, Howard Glasscock, McElroy, North Cowden, Penwell, Puckett, Shipley-Queen, TXL-Tubb, TXL-Wolfcamp (North), University - Waddell, Wasson.

**UTAH**
Aneth Area, Red Wash.

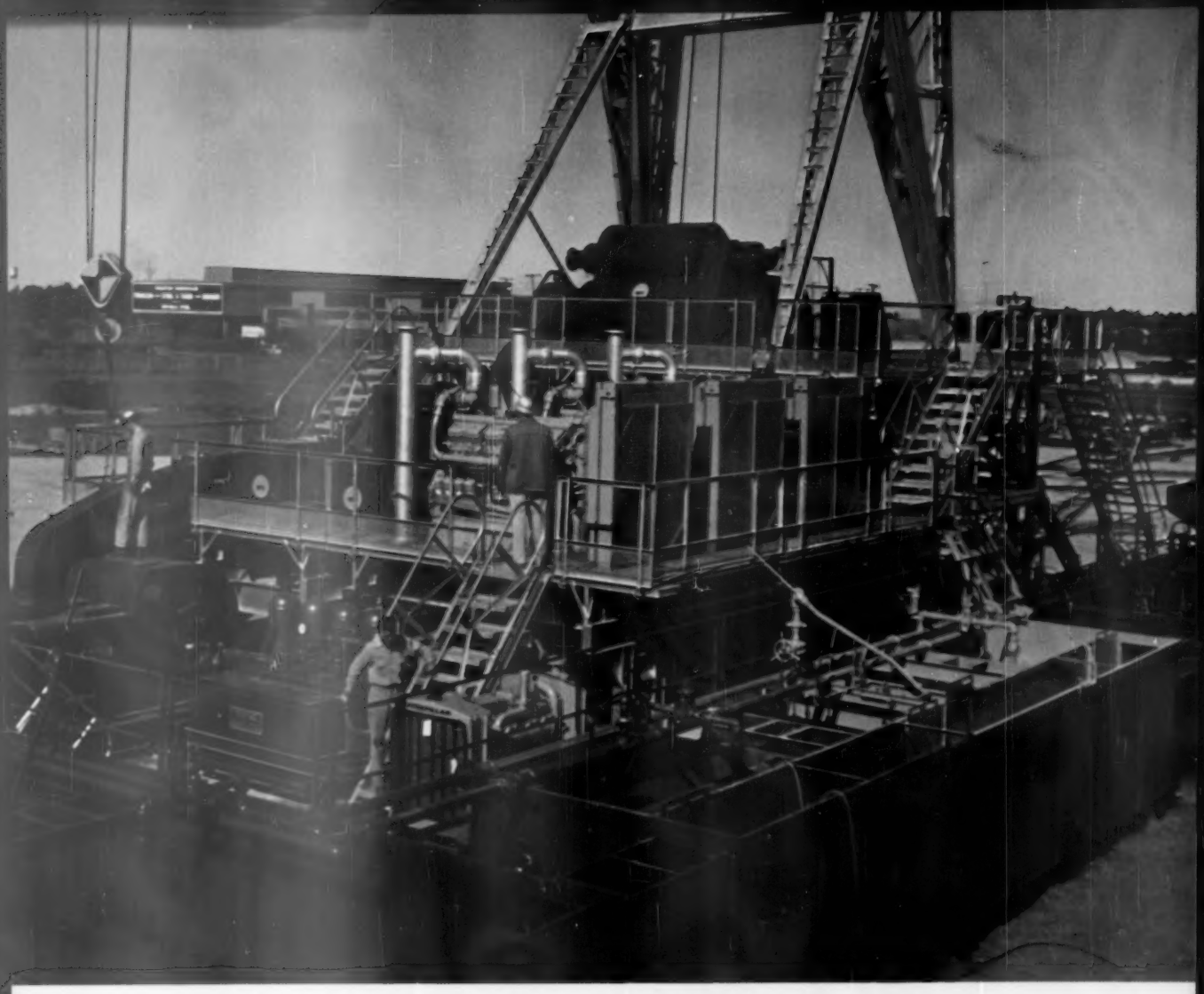
**WYOMING**
Big Piney, Hamilton Dome, La Barge, Miller Creek, Patrick Draw, Rozet, West Desert Springs.

### Canada

**ALBERTA**
Crossfield, Simonette River, Swan Hills, Waterton Park.

**BRITISH COLUMBIA**
Fort Nelson.

**ONTARIO**
Offshore Lake Erie.



This is a complete rig-up of a National Supply rig before shipment from Houston, Texas.

# National Supply's Rig-Up Service pays for itself by eliminating problems at the well site

National's optional rig-up service can prevent many costly problems with rigs destined for domestic or overseas service. National Supply facilities and crews at Torrance, Calif., and Houston, Texas, are available for complete assembly of the rig, test operation, lubrication and adjustment. This service is your assurance that field assembly will be fast and 100% effective. It pays off by preventing delays when downtime can ruin a schedule. Your National Supply representative will be glad to discuss the details of this self-liquidating service with you.

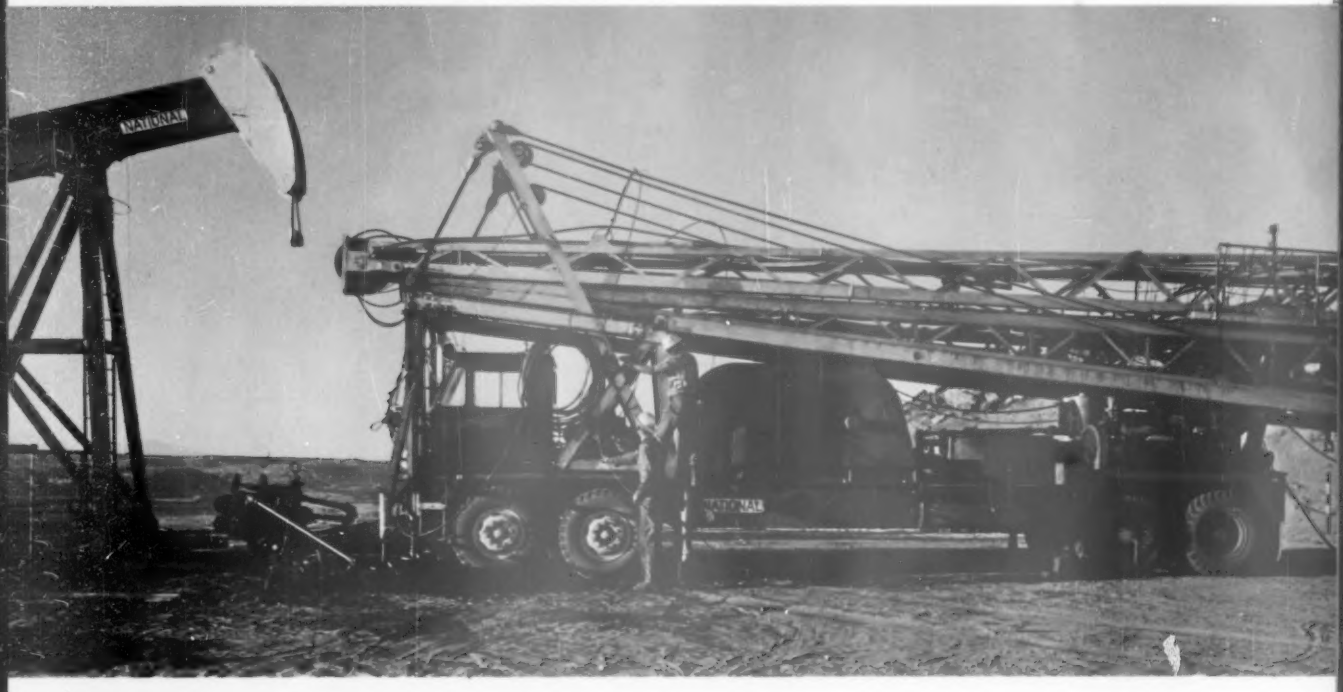
***See next pages for information on National Self-Contained Rigs***

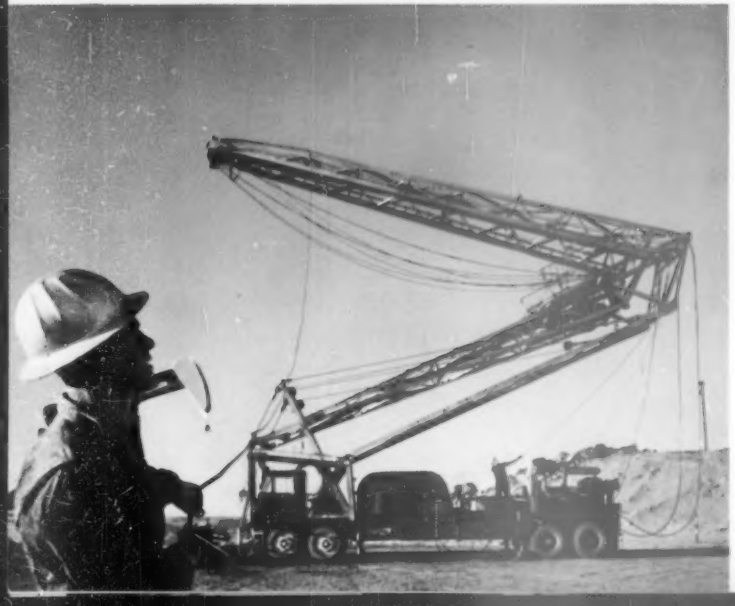
# National's SELF-CONTAINED Drive-In Rigs set new standards of portability, speed, safety

Balance, modern design, conservative ratings and accessibility of all working parts . . . these are a few of the many reasons why National's *Self-Contained* Drive-in rigs are superior.

Both National Supply self-propelled Drive-in rigs, the Model 200 and Model 300-B, are carefully engineered for every oil country job from rod and tubing servicing to deep workover.

The action picture story on these pages points out only a few of the features of National *Self-Contained* Drive-in rigs. Write for complete information, or call your National Supply representative for details.



1 This National Model 300 Drive-in rig is pulling into location on a remote Colorado drilling site. Roadability and ease of handling of these rigs are due to heavy duty tandem front axles, power steering, and modern Eaton tandem driving axles.

2 Here the folding-type mast is being raised to the vertical position. This mast requires no ground guys, and folding outriggers on the mast superstructure provide stability. Other types of masts are available, depending on customer's preference.

3 The mast is now in vertical position with a minimum of effort or time. Mast clear-heights for the two models are: Model 200—88′5″ and Model 300-B—96′6″. Hydraulic mast erection systems are standard on both Drive-in models.

4 Crew is now ready to start raising tubing. Note the compactness of the National rig. Model 300-B dimensions are as follows: overall length, 49′; width, 8′; wheelbase, 25′. Model 200 dimensions are: overall length, 45′; width, 8′; wheelbase, 19′.

5 This is a side view of the Drive-in rig in place. Hoist controls are extremely convenient and are normally mounted on the right hand mast outrigger. Ample air compressor and air reservoir capacity for rig and vehicular operation is provided. A hydraulic system for tubing tongs is available.

6 Work over and tie-in with tank battery are completed. Both the Model 200 and 300-B are equipped with sand reels of large spooling capacity. Brake rims and blocks on the main and sand reel drums are interchangeable. Although unit is light weight for maximum portability, solid construction assures complete safety in all operations.

Steel

Steel's Symbol of strength, long life, and economy

***See next page for information on new T-45 rig***

Total flexibility of power and portability are features of this 550-horsepower T-45 drilling rig recently shipped to Libya. The rig is transported on six trailers and is the largest and most powerful ever designed for fast transportation in desert areas by the National Supply Company. All trailer wheels are equipped with extra size desert-type tires. As shown above, the rig was rigged-up and test operated at National Supply's Houston, Texas, plant prior to shipment.

# New National T-45 Rig is compact, versatile ... specially suited for trailer mounting

National Supply's new T-45 rig features compactness, light weight and simplicity of construction. The rig is "tailor made" for fast, efficient drilling operations, having automatic, safe and precise air controls for hoisting, braking and rotating functions.

It is designed for use with torque converter equipped engines. The T-45 rig may be powered with one or more engines developing a total of 450 to 600 horsepower. Although the T-45 is offered as a conventional skid mounted drawworks, it is especially suited to trailer mounting. Here are a few of the T-45 features:

**AIR OPERATION** gives precise, synchronized power. Dependable pneumatic equipment gives accurate control of the compressed air power, fully protects the rig for safe operation.

**STREAMLINED CONTROL PANEL** simplifies operation, makes it safer, more precise. Easy-to-reach levers make it easy for operator to control each phase of the drilling cycle.

**WATER JACKETED BRAKE RIMS** give efficient, continuous cooling, and the large main drum affords longer wire line life.

**TORQUE-CONVERTER EQUIPPED ENGINES** permit faster round trips, better pump performance and improved rotary operation.

Write for complete details on new T-45 rigs in Bulletin 504, or call your nearby National Supply representative.

## THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania

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EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C. 1

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## ACTIVE FIELDS

### Alaska

**SWANSON RIVER,** Kenai Peninsula.
Pay: Hemlock. Total depth 12,000 ft.
Costs: Flowing well $550,000. Dry hole $450,000. Day-work rate with pipe $1,900.
Rig time: 100% on day-work rate. Total days 70. Total bits 60.
Casing: 13⅜-in. surface casing set at 3,000 ft. with 2,000 sacks of cement. 7-in. intermediate set at 12,000 ft. with 600 sacks cement.
Mud: Emulsifiers, 95 lb. per cu. ft.

### Arkansas

**AETNA,** Franklin County.
Pay: Atoka and Morrow sands. Total depth 6,800 ft.
Costs: Flowing well $168,000. Day-work rate with pipe $700.
Casing: 16-in. surface casing set at 200 ft. with 250 sacks of cement. Variable intermediate. 2⅜ to 5½-in. oil string.
Mud: Gas drilling medium.
Tops: Morris sand at 2,100 to 5,000 ft.; Cecil sand series, 4,300 to 6,400 ft.; Orr sand at 5,200 to 7,000 ft.; Hale sand, 5,600 to 7,500 ft.
Remarks: Combination cable and rotary tools. 50-50.

**STAMPS AREA,** Lafayette County.
Pay: Ford zone of Smackover. Total depth 8,130 ft.
Costs: Flowing well $126,000. Dry hole $62,000. Footage price $4.50. Day-work rate with drill pipe $650 and without pipe $600.
Rig time: 75% on footage rate. 25% on day rate. Total days 40. Total bits 33.
Casing: 8⅝-in. surface casing set at 1,000 ft. with 700 sacks of cement. 5½-in. oil string set at 8,100 ft. with 575 sacks of cement.
Mud: Gel, 200 sacks; Barite, 700 sacks; thinner, 100 sacks; starch, 30 sacks.
Tops: Hosston at 4,910 ft.; Cotton Valley 5,990 ft.; Buckner 7,860 ft.; Ford at 8,110 ft.
Core data: Ford zone, 4 ft. thick; 603 md. perm.; 18.3% porosity; 2.1% resid. oil sat.; 14.5% total water sat.; gas-condensate drive.

### California

**BEEHIVE BEND,** Glenn County.
Pay: Upper Cretaceous. Total depth 6,500 ft.
Costs: Flowing well $130,000. Dry hole $80,000. Footage price $4.75. Day-work rate with drill pipe $42 per hour, and without pipe $40 per hour.
Rig time: 52% on footage rate. 48% on day-work rate. Total days 22. Total bits 30.
Casing: 9⅝-in. surface casing set at 1,500 ft. with 1,000 sacks of cement. 5½-in. oil string set at 6,500 ft. with 600 sacks of cement. Gun or set perforate for completion.
Mud: Gel, 5 tons; weighting material, 65 tons; quebracho, 1½ tons; phosphates, 1½ tons; caustic, ½ ton.
Tops: Upper Cretaceous at 3,500 to 6,500 ft.
Core data: Upper cretaceous, 300 md. permeability; 28% porosity; 30% total water sat.; and estimated recovery is 60 to 90% of gas in place. No water drive apparent.

**BEVERLY HILLS,** Los Angeles County.
Pay: Upper Miocene. Total depth 10,000 ft.
Costs: Flowing well $275,000. Day-work rate with pipe $1,140 and without pipe $1,070.
Rig time: 100% on day-work rate. Total days 45. Total bits 44.
Casing: 16-in. surface casing set at 600 ft. with 425 sacks of cement. 7-in. oil string set at 10,000 ft. with 750 sacks of cement. Gun perforation completion.
Mud: Clay-water, 80 lb. per cu. ft. low pH-oil emulsion, 85 lb. per cu. ft.

**CHEVIOT,** Los Angeles County.
Pay: Upper Miocene. Total depth 10,000 ft.
Costs: Flowing well $270,000. Day-work rate with pipe $1,300.
Rig time: 100% on day-work rate. Total days 65. Ttotal bits 40.
Casing: 13⅜-in surface casing set at 900 ft. with 750 sacks of cement. 7-in. oil string set at 9,000 ft. with 600 sacks of cement. 5½-in. liner (slotted or gun-perforated).
Mud: Clay-water, 75 lb. per cu. ft. Oil emulsifier, 80 lb. per cu. ft.

**NORTH TEJON,** Kern County.
Pay: Vedder. Total depth 11,800 ft.
Costs: Flowing well $325,000. Dry hole $230,000. Footage price $7.50. Day-work rate with pipe $49 per hour and without pipe $48 per hour.
Rig time: 40% on footage rate. 60% day-work rate. Total days 90. Total bits 100.
Casing: 11¾-in. surface casing set at 1,350 ft. with 1,100 sacks of cement. 7-in. oil string set at 11,300 ft. with


Patent Pending

# No-Wall-Stick Drill Collars

effectively reduce sticking of drill collars. . .

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## No-Wall-Stick Drill Collars

The surface area of these drill collars has been changed to reduce wall contact area by more than 40%. Weight loss of the drill collar is only about 4%. Reduction of 40% in contact area results in a proportionate decrease in the total sticking force due to differential pressure of 40%. This design also gives a section of pressure equalization each foot along the body of the drill collar.

Three sizes (6", 4¾", 4¼") of NO-WALL-STICK DRILL COLLARS are available on a rental basis in the Texas and Louisiana Gulf Coast area. Rental price of these NO-WALL-STICK DRILL COLLARS is very competitive to conventional drill collars run with stabilizers.

Any new or used drill collars, regardless of size, owned by Drilling Contractors or Oil Companies may be converted to NO-WALL-STICK DRILL COLLARS for a fixed conversion charge.

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## ACTIVE FIELDS

4,200 sacks of cement. Lightweight mixes on oil string.

Mud: Normal clay base mud, 1,350-8,000 ft., 68-80 lb. per cu. ft.; 45-60 vis.; 8-6 cc. water loss. Clay base with 6-8% lease oil, 8,000-9,000 ft. 76-80 lb. per cu. ft.; 45-60 vis.; 4-5 cc. 9,400 ft. to total depth 80-82 lb. per cu. ft., 80-100 vis., 3-4 cc. Often cement 7 in. at top of zone, then change over to oil-base mud.

Tops: Olcese sand at 7,500 ft.; Basalt at 9,400 ft. and Vedder sands at 11,300.

**OXNARD,** Ventura County.

Pay: McInnes. Total depth 6,600 ft.

Costs: Well on pump $175,000. Dry hole $110,000. Footage price $20. Day-work rate with pipe $1,800.

Rig time: 60% on footage rate; 40% on day-work rate. Total days 25. Total bits 30.

Casing: 9⅝-in. surface casing set at 1,100 ft. with 600 sacks of cement. 5½-in. oil string set at 6,600 ft. with 200 sacks of cement.

Mud: Emulsion.

Tops: Sespe at 6,500 ft., 100-ft. thick.

Core data: Sespe formation; 550 md. perm.; 22% porosity; 56% resid. oil sat.; 30% total water sat. Estimated recovery: 100 bbl. per acre-ft., gas expansion.

**VENTURA AVENUE,** Ventura County.

Pay: D-8. Total depth 12,900 ft.

Costs: Flowing well $380,000. On pump $385,000. Dry hole $290,000. Footage price $10.05. Day-work rate with pipe $1,300 and without pipe $1,300.

Rig time: 80% on footage rate; 20% on day-work rate. Total days 77. Total bits 110.

Casing: 11¾-in. surface casing set at 5,300 ft. with 1,500 sacks of cement. 7⅝-in. intermediate set at 11,950 ft. with 1,200 sacks of cement. 5-in. oil string (liner) set at 12,750 ft.

Mud: Clay-water, 737 lb.; oil base, 1,200 bbl.

Tops: D-8 at 12,000 ft.; D-8 at 11,000, and D-6 at 9,800 ft.

Core data: D-8 formation; 750 ft. interval; 7.4% md. perm.; 13.8% porosity; 45% resid. oil sat.; 48% total water sat. Estimated recovery: 85 bbl. per acre-ft. in D-8 zone. Primarily expansion of undersaturated liquid.

**WILMINGTON,** Los Angeles County.

Pay: Upper Terminal. Total depth 3,600 ft.

Costs: Well on pump $90,000. Footage price $5.25. Day-work rate with pipe $852; without pipe $852.

Rig time: 90% on footage rate; 10% on day-work rate. Total days 12. Total bits 6.

Casing: 13⅜-in. set at 354 ft. with 195 sacks of cement. 9⅝-in. intermediate at 3,000 ft. with 120 sacks of cement. 6⅝-in. oil string at 3,600 ft.

Mud: Clay-water and oil-base drilling fluid.

Tops: TAR at 2,100 ft.; Ranger at 2,400 ft.; Upper Terminal at 3,000 ft. and Lower Terminal at 3,600 ft.

Core data: TAR formation; 2,000 md. perm. 38% porosity; 75.5% resid. oil sat; 15% total water sat. Ranger formation, 1,000 md. perm.; 35% porosity; 63% resid. oil sat.; 22% total water sat. Upper Terminal formation, 800 md. perm.; 35% porosity; 60.5% resid. oil sat.; 25% total water sat. Recovery, bbl. per acre-ft.: TAR 260; Ranger 440; Upper Terminal 460. Gas expansion.

## ACTIVE FIELDS

### Colorado

**DIVIDE CREEK,** Mesa County.
Pay: Mesaverde sandstone. Total depth 4,800 ft.
Costs: Flowing well $90,000. Dry hole $55,000. Footage price $9.00. Day-work rate without drill pipe $925. 1½ cents per foot per day drill-pipe rental.
Rig time: 100% day-work rate. Total days 30. Total bits 17.
Casing: 8⅝-in. surface casing set at 350 ft. with 200 sacks of cement. 4½-in. oil string set at 4,800 ft. with 350 sacks of cement.
Tops: Mancos shale at 4,790 ft.
Core data: Estimated recovery: 300 M.c.f. gas per acre-ft.

**McCLAVE,** Kiowa County.
Pay: Morrow. Total depth 5,000 ft.
Costs: Flowing well $70,000. Dry hole $52,000. Footage price $4.35. Day-work rate with pipe $550 and without pipe $400.
Rig time: 90% on footage rate; 10% on day-work rate. Total days 22; total bits 25.
Casing: 9⅝-in. surface casing set at 400 ft. with 225 sacks of cement. 5½-in. oil string set at 4,000 ft. with 260 sacks of cement.
Mud: Gel mud, 9.3 lb. per gal.; 50 cc. visc.; 5 cc. water loss; 8% oil. Cost $3,300.
Tops: Stone Corral at 2,050 ft.; Marmaton at 4,050 ft.; Cherokee at 4,200 ft.; Morrow at 4,650 ft.; Mississippi at 4,950 ft.

**S. E. LISBON,** San Miguel County.
Pay: Mississippian. Total depth 9,800 ft.
Costs: Flowing well $300,000. On pump $315,000. Dry hole $230,000. Footage price $11. Day-work rate with pipe $1,050 and without pipe $1,000.
Rig time: 70% on footage rate; 30% on day-work rate. Total days 135. Total bits 80.
Casing: 13⅜-in. surface casing set at 650 ft. with 400 sacks of cement. 9⅝-in. intermediate set at 3,000 ft. with 900 sacks of cement. 5½-in. oil string set at 9,800 ft. with 700 sacks of cement.
Mud: Salt, 3,000 lb.; caustic, 200 lb.; lignosulfonate, 100 lb.; oil, 3-6 bbl.; soda ash, 50 lb.
Tops: Mississippian at 8,750 ft.; Ouray at 9,000 ft.; Elbert at 9,100 ft. and McCracken at 9,200 ft.

### Kansas

**PLEASANT PRAIRIE,** Haskell County.
Pay: Mississippian. Total depth 5,150 ft.
Costs: Flowing well $65,000. On pump $75,000. Dry hole $35,000. Footage price $4.50. Day-work rate with pipe $650 and without pipe $600.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 15. Total bits 19.
Casing: 8⅝-in. surface casing (24 lb.) set at 800 ft. with 400 sacks of cement. 5½-in. oil string (14-15 lb.) at 5,200 ft. with 650 sacks of cement. Two-stage cement job was run on oil string through the Hugoton series.
Mud: Hulls, 900 lb.; soda ash, 25 lb.; lime, 200 lb.; caustic soda, 600 lb.; quebracho, 2,000 lb.; mud fiber, 80 lb.
Tops: Lansing-Kansas City at 4,300 ft.; Marmaton at 4,600 ft. Morrow at 5,000 ft.; Mississippi at 5,100 ft.
Core data: Mississippi B-zone, 75 ft.

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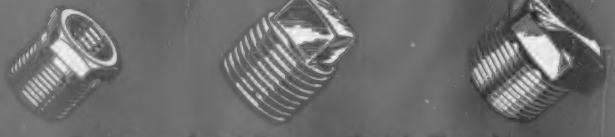

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Milled threads are perfectly formed to guarantee tightness.

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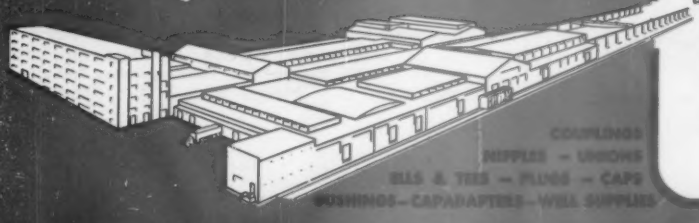


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DIVISION OF HARSCO CORP.
COLUMBUS, OHIO

interval; 2.3 md. perm.; 10.2% porosity; 64% resid. oil sat.; 32.4% total water sat.; Mississippi C-zone; 10.5 ft. interval; 130.0 md. perm., 12.8% porosity; 54% resid. oil sat.; 42.3% total water sat. Estimated recovery bbl. per acre-ft.: B-zone 84; C-zone 90. Gas expansion.

## Louisiana

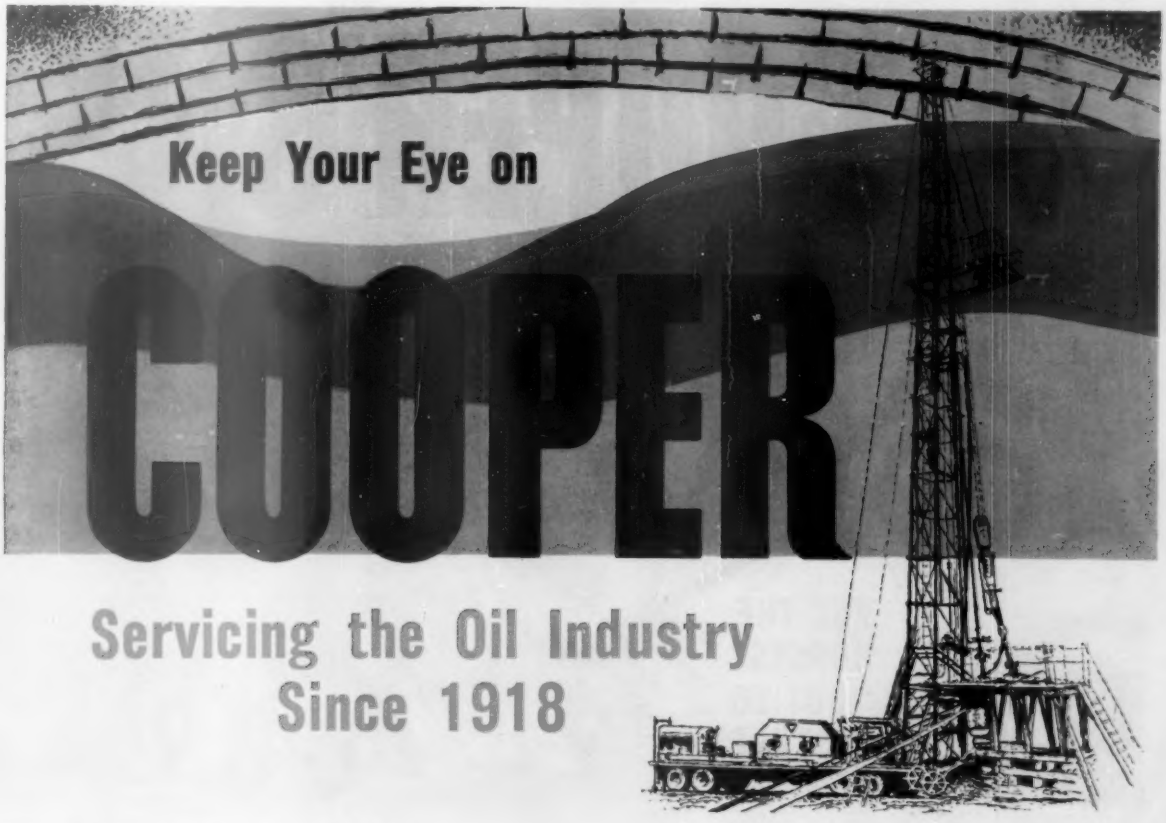
**BASTIAN BAY,** Plaquemines Parish.
Pay: Miocene Series; J, L, N, and O sands. Total depth 14,540 ft.
Costs: Flowing well $850,000. Dry hole $500,000. Footage price $5.75. Day-work rate with pipe $1,750 and without pipe $1,675.
Rig time: 45% on footage rate. 55% on day-work rate. Total days 45. Total bits 25.
Casing: 13⅜-in. surface casing set at 4,500 ft. with 1,400 (1-1-4 Stratacrete gel.) sacks of cement. 9⅝-in. intermediate at 13,000 ft. with 1,000 sacks of cement. 7-in. oil string at 15,400 ft. (total depth) with 500 sacks of cement.
Mud: High-pH lime based mud below 10,000 ft. Mazimum weight 14.5 lb. per gal. Completion mud: low solids CMC.
Tops: J sand, gas at 10,915 ft.; L sand, gas at 11,435 ft.; N sand, gas at 12,200 ft.; O sand, gas, at 12,600 ft.
Core data: J sand, 30-ft. interval; 285 md perm.; 29% porosity; 18% resid. gas sat.; 53% total water sat. L sand, 30-ft. interval; N sand, 100-ft. interval, 80 md. perm.; 22% porosity; 28% resid. gas sat.; 50% total water sat. O sand, 45-ft. interval; 35 md. perm. Estimated recovery: M.c.f. per acre-ft. 1,823 avg., gas expansion.

**BLOCK 24,** South Pass Area.
Pay: Upper Miocene sands. Total depth 8,000 ft.
Costs: Flowing well $115,000. Dry hole $75,000. Footage price $3. Day-work rate with pipe $1,400 and without pipe $1,300.
Rig time: 75% on footage rate. 25% on day-work rate. Total days 10. Total bits 6.
Casing: 10¾-in. surface casing set at 1,800 ft. with 900 sacks of cement. 7-in. oil string set at total depth with 500 sacks of cement.
Mud: Weighting material, 2,000 sacks; gel, 200 sacks; quebracho, 100 sacks; clay, 150 sacks; SAPP, 20 sacks; caustic, 4,000 lb.
Tops: N-4 at 7,200 ft.; P at 7,800; Q at 8,000; T at 9,300.
Core data: Upper Miocene sands, 300 md. perm.; 32% porosity; 15% resid. oil sat.; 75% total water sat. Estimated recovery: 500 bbl. acre-ft. gas expansion and 800 bbl. per acre-ft., water drive.

**GRAND BAY,** Plaquemines Parish.
Pays: 8,500 and 7,500 ft.
Costs: Flowing well $121,000. Dry hole $80,000. Footage price $2.50. Day-work rate with pipe $1,400 and without pipe $1,250.
Rig time: 85% on footage rate. 15% on day-work rate. Total days 8. Total bits 5.
Casing: 10¾-in. surface casing set at 2,000 ft. with 1,200 sacks of cement. 7-in. oil string set at 8,550 ft. and 7,550 ft. with 500 sacks of cement.
Mud: Barite, 85 sacks; gel, 22 sacks; quebracho, 78 sacks; gyp, 100 sacks; caustic, 46 sacks; CMC, 15 sacks.
Tops: Upper Miocene 8,450 and 7,450.

**LAKE WASHINGTON,** Plaquemines Parish.
Pay: Shallow east flank Miocene sands. Total depth 3,000 ft.
Costs: Day-work rate with pipe $940 and without pipe $870.
Rig time: 70% on footage rate. 30% on day-work rate. Total days 10. Total bits 3.
Casing: 7-in. surface casing set at 150 ft. 2½-in. oil string set at 3,000.
Mud: Natural normal-weight mud.
Tops: D sand at 2,600 ft.
Core data: D sand, 73-ft. net sand interval; 1,000 md. perm., 30% porosity; 78% resid. oil sat.; 22% total water sat.

**MINDEN (West Side),** Webster Parish.
Pay: Rodessa (oil) and James (gas). Total depth 6,900 ft.
Costs: Flowing well $106,000. On pump $120,000. Dry hole $60,000. Day-work rate with pipe $775 and without pipe $700.
Rig time: 100% on day-work rate. Total days 44. Total bits 23.
Casing: 9⅝-in. surface casing set at 1,000 ft. with 575 sacks of cement. 7-in. oil string at 6,900 ft. with 600 sacks of cement.
Mud: Gel, 9,600 lb.; clay, 3,000 lb.; quebracho, 2,800 lb.; caustic soda, 1,800 lb.; barites, 20,000 lb.; CMC, 100 lb.; lignite, 900 lb.
Tops: Nacatoch at 3,000 ft.; Lower Cretaceous at 5,800 ft.; Rodessa at 6,400 ft. and James at 6,800 ft.



## ACTIVE FIELDS

**MINDEN (East Side),** Webster Parish.
Pay: Paluxy. Total depth 7,700 ft.
Costs: Flowing well $100,000. Dry hole $68,000. Footage price $6.25. Day-work rate with pipe $775 and without pipe $700.
Rig time: 100% on footage rate. Total days 28. Total bits 25.
Casing: 9⅝-in. surface casing set at 1,000 ft. with 575 sacks of cement. 5½-in. oil string at 7,600 ft. with 1,000 sacks of cement.
Mud: Gel, 3,000 lb.; clay, 1,800 lb.; CMC, 400 lb.; quebracho, 3,300 lb.; caustic soda, 2,200 lb.; barite, 400 lb.
Tops: Nacatoch at 3,100 ft., Lower Cretaceous at 5,900 ft., Paluxy at 6,600 ft., Mooringsport at 7,600 ft.

**WEEKS ISLAND,** Iberia Parish.
Pay: Multipte Miocene sands; 9,000 to 17,000 ft. Total depth 14,600 ft.
Costs: Flowing well $285,000. Dry hole $195,000. Footage price $6. Day-work rate with pipe $1,800 and without pipe $1,600.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 57. Total bits 40.
Casing: 10¾-in. surface casing set at 2,500 ft. with 300 sacks of cement. 7-in. oil string at total depth with 500 sacks of cement.
Mud: Barite, 3,000 sacks; gel and clay, 200 sacks; thinners and misc., 35,000 lb.; oil, 500 bbl.
Core data: Miocene, 10,000-18,000 ft. interval; 200 md. perm., 16-28% porosity; mainly water drive.

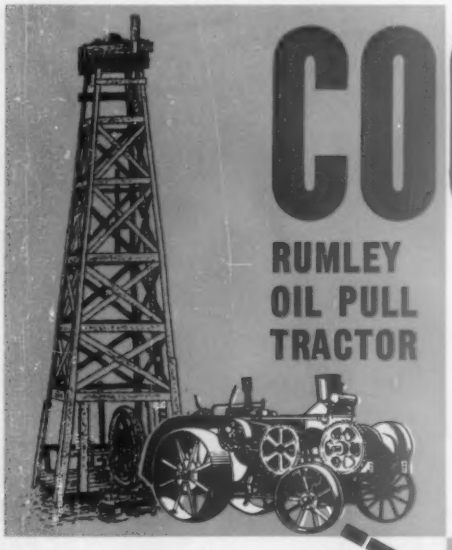
## Michigan

**SCIPIO TREND,** Calhoun, Jackson, Hillsdale counties.
Pay: Trenton-Black River. Total depth 4,200 ft.
Costs: Flowing well $60,000. On pump $68,000. Dry hole $34,000. Footage price $5.50. Day-work rate with pipe $750 and without pipe $650.
Rig time: 18 days footage rate. 3 days day-work rate. Total days 21. Total bits 16.
Casing: 16-in. surface casing set at 300 ft. with 250 sacks of cement. 10-in. or 8-in. intermediate set at 1,000 with 550 sacks of cement. 5½ or 7-in. oil string set at 4,200 ft. with 150 sacks of cement.
Mud: Bentonite, oil, and chemical. Average cost $2,000.
Tops: Traverse at 1,425 ft., Niagara at 2,600 ft., and Trenton at 3,750.
Core data: Estimated recovery in Trenton: 125 bbl. per acre-ft.; probably both gas expansion and water drive.

## Mississippi

**BRYAN,** Jones County.
Pay: Rodessa, Sligo, and Hosston. Total depth 12,000 ft.
Costs: Flowing well $220,000. On pump $240,000. Dry hole $95,000. Footage price $4.75. Day-work rate with pipe $1,050 and without pipe $1,000.
Rig time: 70% on footage rate. 30% on day-work rate. Total days 40. Total bits 25.
Casing: 10¾-in. surface casing set at 1,700 ft. with 625 sacks of cement. 7-in. oil string set at 12,000 ft. with 1,300 sacks of cement.
Mud: Caustic soda, 5,200 lb.; quebracho, 8,600 lb.; gel., 70,000 lb.; high-yield clay, 3,000 lb.
Tops: Rodessa at 10,275 ft.; Sligo at 10,750 ft., Hosston at 11,100 ft.
Core data: Rodessa, 10,241-10,337 ft. interval; 375 md. perm., 18% porosity; 22% resid. oil sat.; 60% total water sat. Sligo, 10,706-11,062 ft. interval; 300 md. perm., 19% porosity; 22% resid. oil sat.; 60% total water sat. Hosston, 11,120-11,640 ft. interval; 175 md. perm., 16% porosity; 25% resid. oil sat.; 60% total water sat.

**MAGEE,** Smith and Simpson counties.
Pay: Hosston and Sligo. Total depth 13,350 ft.
Costs: Flowing well $332,775. On pump $354,775. Dry hole 200,000. Footage price $6.75. Day-work rate with pipe $1,300 and without pipe $1,150.
Rig time: 60% on footage rate. 40% on day-work rate. Total days 75. Total bits 60.
Casing: 16-in. surface casing set at 150 ft. with 125 sacks of cement. 10¾-in. intermediate set at 2,500 ft. with 800 sacks of cement. 7-in. oil string seated at 14,000 ft. with 900 sacks of cement. 5-in. liner set when required.
Mud: Gel, 18.35 tons; barite, 60 tons; CMC, 167 sacks; quebracho, 140 sacks; emulsifier, 34-55 gal. drums; lime, 9 bags; caustic soda, 96 drums; barium carbonate, 107 sacks.
Tops: Hosston at 13,700 ft.; Sligo at 13,000 ft.
Core data: Hosston, 42-ft. interval, 127 md. perm., 12.9% porosity; 14% resid. oil sat.; 35% total water sat. Sligo, 22-ft. interval, 82 md. perm., 14.85% porosity; 16.32% resid. oil sat.; 36.1% total water sat. Estimated recovery:

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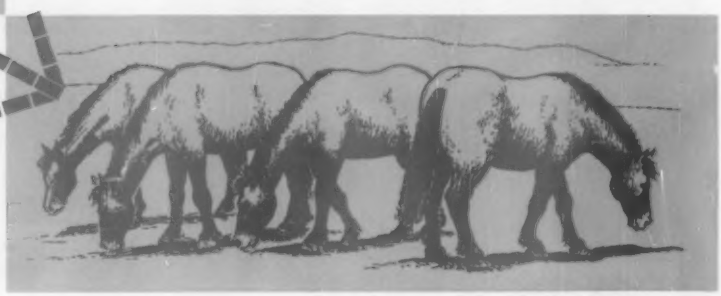

## ACTIVE FIELDS

Hosston 90 bbl. per acre-ft.; Sligo 120 bbl. per acre-ft. Gas expansion.

**RALEIGH,** Smith County.
Pay: Hosston. Total depth 13,000 ft.
Costs: Flowing well: Dual $276,000; single $252,000. Footage price $6.75. Day-work rate with pipe $1,200 and without pipe $1,100.
Rig time: 72% on footage rate; 28% on day-work rate. Total days 62. Total bits 56.
Casing: 10¾-in. surface casing set at 2,100 ft. with 1,200 sacks of cement. 7-in. oil string set at 12,800 ft. with 800 sacks of cement.
Mud: Barite, 7,000 lb.; gel, 1,500 lb.; diesel oil, 23,750 gal.; caustic soda, 7,000 lb.; CMC, 1,600 lb.; quebracho, 12,600 lb.; emulsifiers, 1,087 gal.; Barium carbonte, 6,000 lb.
Tops: Pine Island at 11,430-60 ft.; Hosston at 12,193-12,281 ft.; Hosston 12,324-12,405 ft.; Hosston at 12,732-90 ft.
Core data: Pine Island, 11,368-11,458 ft. interval; 27 md. perm.; 13.5% porosity; 4.2% resid. oil sat.; 45.3% total water sat. Hosston, 12,111-92 ft. interval; 84 md. perm.; 13.4% porosity; 14% resid. sat.; 42% total water sat.; Hosston, 12,651-12-719 ft. interval; 25 md. perm.; 12.2% porosity; 8% resid. oil sat.; 40% total water sat.

### Montana

**CABIN CREEK,** Fallon County.
Pay: Silurian and Ordovician. Total depth 9,100 ft.
Costs: Well on pump $165,000. Footage price $5.65 Day-work rate with pipe $1,075 and without pipe $970.
Rig time: 95% on footage rate. 5% on day-work rate. Total days 28. Total bits 36.
Casing: 9⅝-in. surface casing set at 1,000 ft. with 350 sacks of cement. 7-in. oil string set at 9,100 ft. with 750 sacks of cement.
Mud: Native to 4,900 ft.; salt sat. oil emulsion below 4,900 ft.
Tops: Greenhorn limestone at 2,900 ft.; Dakota at 3,800 ft.; Piper limestone 5,020 ft.; Charles "A" zone 6,800 ft.; Charles "B" zone at 6,930 ft.; Mission Canyon at 7,230 ft.; Silurian at 8,400 ft.; Stone Mountain at 8,750 ft.; Red River at 8,900 ft.

**DWYER,** Sheridan County.
Pay: Mission Canyon. Total depth 8,050 ft.
Costs: Flowing well $92,000. On pump $115,000. Dry hole $57,000. Footage price $3.90. Day-work rate with pipe $1,150 and without pipe $1,050.
Rig time: 98% on footage rate. 2% on day-work rate. Total days 20. Total bits 19.
Casing: 12¼-in. surface casing set at 422 ft. with 215 sacks of cement. 5½-in. oil string set at 8,054 ft. with 110 sacks of cement.
Tops: Fort Union at Surface; Newcastle at 4,415 ft.; Dakota at 4,670 ft.; Spearfish at 6,225 ft.; Pay zone 7,959 ft.

**STENSVAD,** Rosebud County.
Pay: Stensvad-Lower Tyler "B" Total depth 5,390 ft.
Costs: Well on pump $77,300. Dry hole $28,500. Footage price $4.45. Day-work rate with pipe $700 plus 1½ cents, and without pipe $700.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 26. Total bits 15.
Casing: 8⅝-in. surface casting set at 110 ft. with 58 sacks of cement. 5½-in. oil string set at 5,400 ft. with 200 sacks of cement.
Mud: Bentonite, 65 sacks; quebracho, 650 lb.; caustic soda, 100 lb.; 10% oil by volume.
Tops: Dakota at 3,652 ft.; Amsden at 4,822 ft.; Lower Tyler (includes Stensvad) at 5,212 ft., Heath at 5,306 ft.
Core data: Stensvad formation; 5,254-84 ft. interval; 68 md. perm., 13.8% porosity; 14.6% resid. oil sat.; 42.8% total water sat. Estimated recovery: Stensvad, 135 bbl. per acre-ft.; Lower Tyler "B," 135 bbl. per acre-ft. Gas expansion.

**SUMATRA,** Rosebud County.
Pay: Upper Tyler "A," and Lower Tyler "B." Total depth 4,800 ft.
Costs: Well on pump $70,000. Dry hole $26,000. Footage price $4.60. Day-work rate with pipe $700 plus 1½ cents, and without pipe $700.
Rig time: 84% on footage rate. 16% on day-work rate. Total days 20. Total bits 14.
Casing: 8⅝-in. surface casing set at 100 ft. with 50 sacks of cement. 5½-in. oil string at 4,850 ft. with 200 sacks of cement.
Mud: Bentonite, 65 sacks; quebracho, 650 lb.; caustic soda, 100 lb.; 10% oil (by volume).
Tops: Dakota at 3,000 ft.; Amsden at 4,180 ft.; Lower Tyler at 4,500 ft.; and Heath at 4,680 ft.
Core data: Estimated recovery: Upper Tyler "A" sand, 125 bbl. per acre-ft.; Lower Tyler "B" sand, 120 bbl. per


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The biggest building expansion program in the 42 year history of the company has now been completed. It provides 125% more manufacturing space than before with separate shops for painting, repair and fabrication. A new general office with an ample parking area is also a feature of the expansion. Space formerly used for general offices is now devoted to additional parts department, display space, engineering offices, meeting rooms and employee recreation area.

acre-ft.; Lower Tyler "C" sand, 120 bbl. per acre-ft.

NOTE: Data for Sumatra area, a rather vaguely defined area south of N.W. Sumatra field proper; producing sands are "A" and a stray within Upper Tyler; and the Upper "B," the "C" and stray sands in the Lower Tyler. Any particular well may find one, several, or none of these pay sands present.

## Nebraska

**ACKMAN,** Redwillow County.

Pay: Topeka and Lansing-Kansas City. Total depth 3,250 ft.

Costs: Well on pump $40,000. Dry hole $18,000. Footage price $2.75. Day-work rate with pipe $700 and without pipe $650.

Rig time: 80% on footage rate. 20% day-work rate. Total days 7. Total bits 10.

Casing: 8⅝-in. surface casing set at 285 ft. with 200 sacks of cement. 4½-in. oil string set at 3,450 ft. with 125 sacks of cement.

Mud: Chemical-gel. Cost $1,000.

Tops: Oread (Topeka) at 3,200 ft.; B-Zone, Lansing-Kansas City at 3,250 ft.; C-Zone, Lansing-Kansas City at 3,300 ft.

Core data: Oread: 181 md. perm.; 18% porosity; 17% resid. oil sat.; 60% total water sat. B-Zone: 49 md. perm.; 8% porosity; 25% resid. oil sat.; 48% total water sat. C-Zone: 30 md. perm.; 15% porosity; 17% resid. oil sat.; 54% total water sat.

**REIHER,** Hitchcock County.

Pay: Lansing-Kansas City. Total depth 4,200 ft.

Costs: Well on pump $65,000. Dry hole $19,000. Footage price $3.50 Day-work rate with pipe $600 and without pipe $500.

Rig time: 90% on footage rate. 10% on day-work rate. Total days 9. Total bits 9.

Casing: 8⅝-in. surface casing set at 172 ft. with 175 saks of cement. 5½-in. oil string set at 4,100 ft. with 250 sacks of cement.

Mud: Chemical-oil emulsion.

Tops: Topeka at 3,550 ft.; Oread at 3,620 ft.; Lansing-Kansas City at 3,680 ft.

Core data: Oread: 3,613-33 ft. interval; 90 md. perm.; 18% porosity; 35.6% resid. oil sat.; 37% total water sat. Lansing-Kansas City: 3,701-5 ft. interval; 66 md. perm.; 22% porosity; 20.1% resid. oil sat.; 46% total water sat. Lansing-Kansas City: 3,824-29 ft. interval; 84 md. perm.; 18.9% porosity; 24.6% resid. oil sat.; 48.3% total water sat. Estimated recovery bbl. acre-ft. (gas expansion): Oread 739; Lansing-Kansas City 756; Lansing-Kansas City 644.

## New Mexico

**BLANCO,** San Juan County.

Pay: Mesaverde. Total depth 5,500 ft.

Costs: Flowing well $80,000. Dry hole $48,000. Footage price $5. Day-work rate with drill pipe $725, and without pipe $650.

Rig time: 85% on footage rate. 15% on day rate. Total days 18. Total bits 15.

Casing: 10¾-in. surface casing set at 150 ft. with 150 sacks of cement. 7⅝-in. intermediate string set at 3,000 ft. with 200 sacks of cement. 5-in. liner at 5,500 ft. with 200 sacks of cement. Note: gas drilled below 7⅝-in. pipe.

Mud: Gel and lost-circulation material. Fresh water drilling to 1,500 ft. Gas drilling below 3,000 ft.

Tops: Pictured Cliffs at 2,600 ft.; Cliff House at 4,300 ft.; Menefee at 4,380 ft.; Point Lookout at 4,900 ft.

**GRAYBURG,** Eddy County.

Pay: Grayburg (San Andres and Premier sands). Total depth 3,800 ft.

Costs: Flowing well $44,000. On pump $50,000. Dry hole $22,000. Footage price $3.90. Day-work rate without drill pipe $300.

Rig time: 80% on footage rate. 20% on day-work rate. Total days 43. (Cable tools.)

Casing: 8⅝-in. surface casing set at 800 ft. with 125 sacks of cement. 5½-in. oil string set at 3,670 ft. with 375 sacks of cement.

Mud: Gel, 5 sacks.

Tops: Anhydrite at 539 ft.; salt at 733 ft.; Yates at 1,835 ft.; Seven Rivers at 2,196 ft.; Queen at 2,812 ft.; Grayburg at 3,202 ft.; Premier at 3,492 ft. (Premier sand is part of Grayburg formation); San Andres at 3,586 ft.

Core data: Estimated recovery: 50 bbl. per acre-ft. with solution gas-drive mechanism.

**LANGLIE-MATTIX,** Lea County.

Pay: Queen. Total depth 3,650 ft.

Costs: Flowing well $39,000. On pump $50,000. Dry hole $25,000. Footage price $3.50. Day-work rate with pipe $550 and without pipe $500.

Rig time: 95% on footage rate. 5% on day-work rate. Total days 11. Total bits 14.


**NEW BUILDINGS**
**Designed to**
**BUILD and SERVICE**
**Larger Machines**

Cooper's new Fabrication Shop was specially constructed with overhead room sufficient to handle the largest Cooper rigs. It provides 95 per cent more floor space in addition to the original fabrication area.

Floor space in the new Repair Shop was doubled to allow even more room than is required for servicing Cooper's largest rigs or smallest engine units.

The new Paint Shop now provides 178 per cent more floor space in that department. Automatic temperature control, special ventilating system with water screen exhaust and proper lighting assure superior paint jobs.

All areas are provided with heavy duty material handling equipment:

(1) Fabrication Shop
(2) Repair Shop
(3) Paint Shop

(1)

(2)

(3)

## ACTIVE FIELDS

Casing: 8⅝-in. surface casing set at 354 ft. with 208 sacks of cement. 4½-in. oil string set at 3,369 ft. with 400 sacks of cement.
Mud: Bentonite, 40 sacks; lime, 5 sacks; salt-gel, 150 sacks; starch, 10 sacks; redwood bark, 3 sacks.
Tops: Queen at 3,465 ft.

**MALJAMAR,** Lea County.
Pay: Grayburg-San Andres. Total depth 4,200 ft.
Costs: Flowing well $60,000. On pump $75,000. Footage price $3.75. Day-work rate with pipe $650; without pipe $600.
Rig time: 68% on footage rate; 32% on day-work rate. Total days 18. Total bits 8.
Casing: 8⅝-in. surface casing set at 235 ft. with 135 sacks of cement. 5½-in. oil string set at 4,200 ft. with 850 sacks of cement.
Mud: Salt gel, 75 sacks.
Tops: Top of salt at 900 ft.; base of salt at 1,900 ft.; Grayburg at 3,415 ft.; San Andres at 3,800 ft.
Core data: Grayburg: 3,415-3,800 ft. interval; 8 md. perm.; 9% porosity; 83% resid. oil sat.; 17% total water sat. San Andres: 3,800-4,200 ft. interval; 5 md. perm.; 7% porosity; 83% resid. oil sat.; 17% total water sat. Estimated recovery: 117 bbl. per acre-ft. Gas expansion (both horizons).

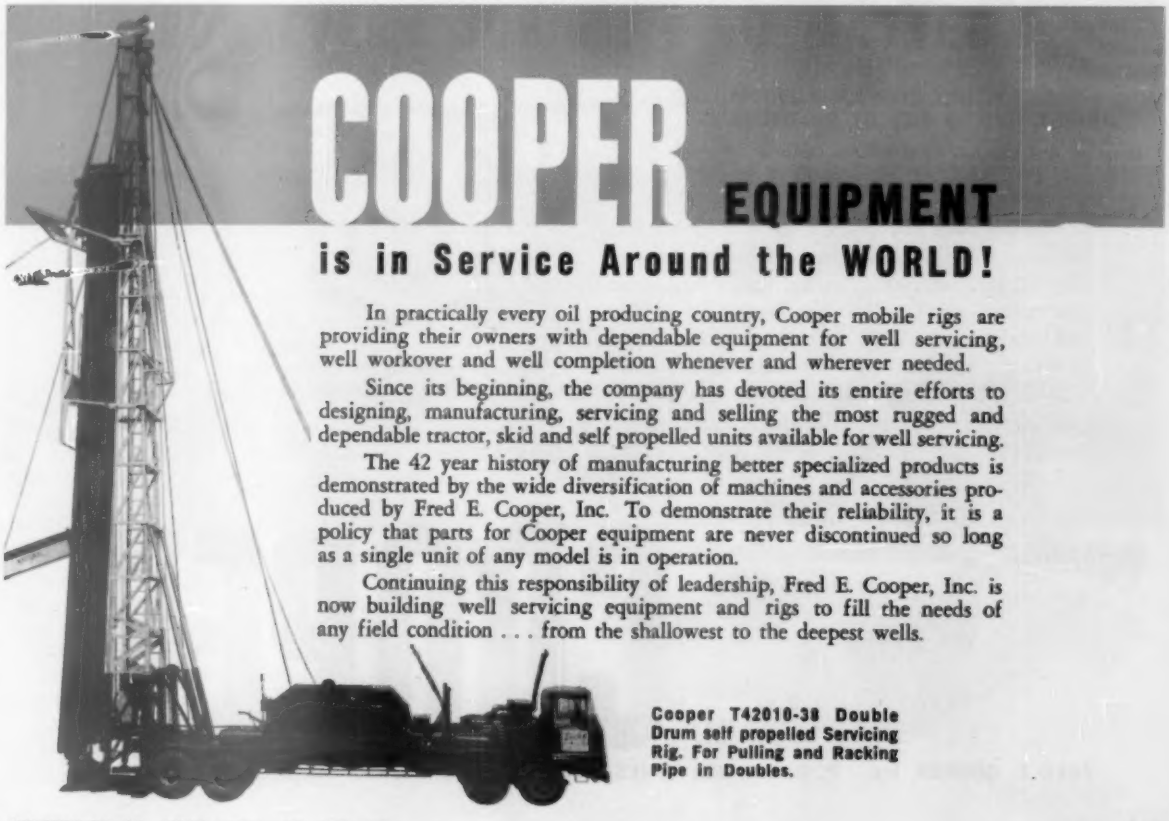
**VERDE-HORSESHOE CANYON,** San Juan County.
Pay: Lower Gallup. Total depth 3,000 ft.
Costs: Well on pump $45,000. Dry hole $35,000. Footage price $5.50. Day-work rate with pipe $440 and without pipe $400.
Rig time: 90% on footage rate; 10% on day-work rate. Total days 20. Total bits 4.
Casing: 8⅝-in. surface casing set at 150 ft. with 100 sacks of cement. 5½-in. oil string set at 3,000 ft. with 50 sacks of cement.
Mud: Spud mud. Water (gel chemical while drilling pay).
Tops: Point Lookout at 900 ft.; Mancos at 1,250 ft.; Gallup at 2,300 ft.; Lower Gallup at 2,500 ft.

**HORSESHOE CANYON,** San Juan County.
Pay: Lower Gallup or Tacito. Total depth 1,500 ft.
Costs: Well on pump $25,000. Dry hole $17,000. Footage price $3.50. Day-work rate with drill pipe $650 and without pipe $600.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 7. Total bits 2.
Casing: 8⅝-in. surface casing set at 100 ft. with 75 sacks of cement. 5½-in. oil string set at 1,500 ft. with 100 sacks of cement.
Mud: Gel chemicals to top zone; oil emulsion to pay.
Tops: Lower Gallup at 1,200 ft.; Sanostee at 1,500 ft.
Core data: Gallup-Upper pay: 30 md. perm., 16.5% porosity; 33% total water sat. Gallup-Lower pay: 90 md. perm., 17.5% porosity; 31% total water sat. Estimated recovery: 110 bbl. per acre-ft. Gas expansion.

## North Dakota

**BLUE BUTTES,** McKenzie County.
Pay: Madison. Total depth 9,400 ft.
Costs: Flowing well $136,500. On pump $156,000. Dry hole $91,000. Day-work rate with pipe $925. Drill-pipe rental is 1½ cents per foot.
Rig time: 100% on day-work rate. Total days 32. Total bits 39.
Casing: 9⅝-in. surface casing set at 620 ft. with 450 sacks of cement. 5½-in. oil string set at 9,350 ft. with 1,200 sacks of cement.
Mud: Salt gel, 74 sacks; bentonite, 40 sacks; hulls, 28 sacks; mica, 80 sacks; starch, 286 sacks; salt, 2,000 sacks; oil, 380 bbl.
Tops: Greenhorn at 4,162 ft.; Skull Creek at 4,703 ft.; Dakota at 4,950 ft.; Ellis at 5,545 ft.; Spearfish at 6,307 ft.; First Permian salt at 6,621 ft.; Second Permian salt at 6,924 ft.; Amsden at 7,505 ft.; Kibbey limestone at 8,145 ft.; Charles at 8,288 ft.; Last salt at 8,881 ft.; Madison at 8,828 ft., pay at 9,126 ft.

**GLENBURN,** Renville County.
Pay: Mission Canyon. Total depth 4,515 ft.
Costs: Flowing well $47,000. On pump $57,000. dry hole $25,000. Footage price $3.75.
Costs: Day-work rate with pipe $950, and without pipe $900.
Rig time: 75% on footage rate. 25% on day-work rate. Total days 13. Total bits 10.
Casing: 9⅝-in. surface casing set at 425 ft. with 200 sacks of cement. 5½-in. oil string set at 4,500 ft. with 125 sacks of cement.
Mud: Water base to Piper lime, gyp base from Piper lime to total depth.
Tops: Charles at 4,070 ft.; Mission Canyon at 4,390 ft.; Mission Canyon pay tankage. Footage price $4.30. Day-work at 4,500 ft.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Since its beginning, the company has devoted its entire efforts to designing, manufacturing, servicing and selling the most rugged and dependable tractor, skid and self propelled units available for well servicing.
The 42 year history of manufacturing better specialized products is demonstrated by the wide diversification of machines and accessories produced by Fred E. Cooper, Inc. To demonstrate their reliability, it is a policy that parts for Cooper equipment are never discontinued so long as a single unit of any model is in operation.
Continuing this responsibility of leadership, Fred E. Cooper, Inc. is now building well servicing equipment and rigs to fill the needs of any field condition . . . from the shallowest to the deepest wells.
Cooper T42010-38 Double Drum self propelled Servicing Rig. For Pulling and Racking Pipe in Doubles.

## ACTIVE FIELDS

Core data: Estimated recovery: 2,500 bbl. per acre-ft. Water drive.

**RIVAL,** Burke County.
Pay: Madison. Total depth 6,300 ft.
Costs: Flowing well $61,000. On pump $75,000. Dry hole $44,000, excluding rate with pipe $940 and without pipe $875.
Rig time: 85% on footage rate. 15% on day-work rate. Total days 18. Total bits 13.
Casing 8⅝-in. surface casing set at 500 ft. with 450 sacks of cement. 4½-in. oil string set at 6,300 ft. with 325 sacks of cement.
Mud: Starch, 2,800 lb.; gel, 2,700 lb.; salt gel, 2,300 lb.; gypsum, 2,000 lb.; preservative 800 lb.; cottonseed hulls, 800 lb.; lime phosphate, 500 lb. Note: Some operators use gyp-base mud converted to mud at 5,000 ft. after drilling upper section with clear water.
Tops: Dakota at 3,945 ft.; Piper lime at 4,890 ft.; Nesson main pay at 6,135 ft.; Mission Canyon at 6,200 ft.
Core data: Nesson main pay: 28 ft. intervals; 3 md. perm., 6.8% porosity; 10% resid. oil sat.; 41% total water sat. Estimated recovery: 40 bbl. per acre-ft. Gas expansion.

### Ohio

**CONNEAUT,** Ashtabula County.
Pay: Medina sandstone. Total depth 3,300 ft.
Costs: Flowing gas well $30,000. Oil on pump $35,000. Dry hole $17,000. Footage price $4.
Rig time: 90% on footage rate. Cable tools.
Casing: 10¾-in. surface casing set at 200 ft. with shoe. 7-in. intermediate set at 2,300 ft. with shoe. 5½-in. oil string set at 3,300 ft. with 30 sacks.
Tops: Oriskany sandstone at 2,200 ft.; Medina sandstone at 3,200 ft.

**SWAN TOWNSHIP,** Vinton County.
Pay: Clinton. Total depth 2,800-3,000 ft.
Costs: Gas well $21,000. Flowing oil well $26,000. Oil on pump $30,000. Dry hole $14,000. Footage price $2.75. Day-work rate, 8-hr. $65.
Casing: 10-in. surface casing set at 30 ft. 4½-in. oil string set at 2,800 ft. with 35 sacks of cement.
Tops: Packer shell (marker) at 2,815-25 ft.; Clinton sand at 2,845-70 ft.
No rotaries working in the area. Clinton is a gas-expansion drive.

### Oklahoma

**CHEROKEE TREND,** Alfalfa County.
Pay: Basal Pennsylvanian. Total depth 5,300 ft.
Costs: Flowing well $46,500. Dry hole $24,000. Footage price $2.70. Day-work rate with drill pipe $675, and without pipe $600.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 18. Total bits 14.
Casing: 8⅝-in. surface casing set at 300 ft. with 200 sacks of cement. 4½-in. oil string at 5,200 ft. with 300 sacks of cement.
Mud: Bentonite, 50 sacks; attapulgite clay, 144 sacks; salt gel, 252 sacks; starch, 2,450 lb.; preservative, 100 lb.; hulls, 38 sacks; lime, 1 sack.
Tops: Layton at 4,594 ft.; Des Moines at 4,900 ft.; Basal Pennsylvanian at 5,180 ft.; Pennsylvanian-Mississippian contact at 5,240 ft.
Core data: Basal Pennsylvanian (Red Fork sand) 4,959-77 ft. interval; 7.4 md. permeability; 13.1% porosity; 18% resid. oil sat.; 41% total water sat.

**ENVILLE,** Love County.
Pay: Oil Creek. Total depth 11,000 ft.
Costs: Flowing well $375,000. Dry hole $340,000. Day-work rate with pipe: 0-5,000 ft., $800; 5,000-7,500 ft., $850; 7,500-10,000 ft., $925; 10,000-12,000 ft., $950; without pipe: 0-5,000 ft., $750; 5,000-7,500 ft., $775; 7,500-10,000 ft., $800; 10,000-12,000 ft., $800.
Rig time: 100% on day-work rate. Total days 258. Total bits 151.
Casing: 20-in. surface casing set at 72 ft. with 150 sacks of cement. 13⅜-in. intermediate set at 1,024 ft. with 200 sacks of cement. 9⅝-in. oil string set at 5,556 ft. with 600 sacks of cement. 7⅝-in. oil string set at 9,655 ft. with 500 sacks of cement. 5½-in. oil string set at 10,620 ft. with 125 sacks of cement.
Mud: Gel, 190 tons; barite, 1,400 tons; soda ash, 20 tons; mica, 20 tons; wood-fiber, 14 tons; flax shive, 6 tons.
Tops: Viola at 7,306 ft.; Bromide at 8,400 ft.; McLish at 9,098 ft.; Oil Creek sand at 10,444 ft. (100 ft. thick.)
Core data: Oil Creek formation: 10,600-10,700 ft. interval; 5.4 md. perm., 4.46% porosity; 5.08 resid*. oil sat. 31.47% total water sat. Estimated recovery: 1,090 M.c.f. per acre-ft. gas expansion and 34 bbl. per acre-ft. gas expansion.

**HUGOTON,** Texas County.
Pay: Chase Group. Total depth 2,650 ft.
Costs: Flowing well $25,000. Dry hole


and what about TOMORROW?

Throughout the years Fred E. Cooper, Inc. has been the pioneer in the development of mobile oil well servicing units. Today that same pioneering spirit still exists in Cooper design and engineering. New machines are developed to exactly fit the latest oil well servicing requirements. Changes are made as soon as new well equipment, methods or depths make them desirable.

Yes, Cooper has made tremendous strides during the last 42 years, but these developments are small compared to the new ideas, new techniques and new machines which will come from Cooper in the future. That's why we have chosen as our slogan "Keep your eye on Cooper." We take pride in the acceptance of Cooper Units by the industry and the growth of our business.

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## ACTIVE FIELDS

$17,000. Footage price $2.50. Day-work rate with pipe $21 and without pipe $17.
Rig time: 83% on footage rate. 17% on day-work rate. Total days 6. Total bits 5.
Casing: 8⅝-in. surface casing set at 300 ft. with 200 sacks of cement. 5½-in. oil string set at 2,650 ft. with 200 sacks of cement.
Mud: Gel, 40 sacks; salt gel, 40 sacks.

**LAVERNE AREA,** Harper County.
Pay: Hoover, Tonkawa, Morrow, and Chester. Total depth 7,300 to 7,600 ft.
Costs: Flowing well $95,000. Footage price $5. Day-work rate with pipe $850 and without pipe $750.
Rig time: 85% on footage rate. 15% on day-work rate. Total days 27. Total bits 22.
Casing: 13⅜-in. surface casing set at 500 ft. with 500 sacks of cement. 8⅝-in. to 9⅝-in. intermediate set at 3,000 ft. with 250 sacks of cement. 5½ to 7-in. oil string set at 7,300-7,600 ft. with sacks of cement.
Mud: Gel and lost-circulation material. Cost averages $2,500 to $4,000.
Tops: Hoover at 4,100 ft.; Tonkawa at 5,400 ft.; Morrow at 6,900 ft.; Chester at 7,100 ft.

**LUTHER HILL,** Ellis County.
Pay: Morrow. Total depth 7,900 ft.
Costs: Flowing well $96,000. Footage price $4.25. Day-work rate with pipe $800 and without pipe $775.
Rig time: 85% on footage rate. 15% on day-work rate. Total days 33. Total bits 26.
Casing: 8⅝-in. surface casing set at 602 ft. with 200 sacks of cement. 5½-in. oil string set at 7,944 ft. with 200 sacks of cement.
Mud: Salt gel and oil emulsion.
Tops: Cherokee at 6,850 ft.; Atoka at 7,186 ft.; Morrow at 7,369 ft.; Chester at 7,696 ft.
Core data: Morrow formation: 7,592-7,601 ft. interval; 5.1 md. perm., 12% porosity; 63% total water sat. Estimated recovery from Morrow 310 M.c.f. per acre-ft.

**MOCANE,** Beaver County.
Pay: Council Grove, Tonkawa, Morrow, and Chester. Total depth 7,500 ft.
Costs: Flowing well $110,000. Dry hole $70,000. Footage price $4.25. Ray-work rate with pipe $750, and without pipe $700.
Rig time: 94% on footage rate. 6% on day-work rate. Total days 33. Total bits 28.
Casing: 13⅜-in. surface casing set at 550 ft. with 400 sacks of cement. 9⅝-in. intermediate set at 2,800 ft. with 500 sacks of cement. 5½-in. oil string set at 7,500 ft. with 500 sacks of cement.
Mud: Gel, 90,000 lb.; lignite, 5,000 lb.; soda ash, 5,000 lb.; caustic soda, 4,000 lb.; lost-circulation material, 40,000 lb.
Tops: Council Grove at 3,400 ft.; Tonkawa at 5,500 ft.; Checkerboard at 6,000 ft.; Morrow at 7,000 ft.; Chester at 7,400 ft.
Core data: Council Grove formation: 20 md. perm., 8.25% porosity; 50% total water sat.; Tonkawa formation: 14 md. perm., 15.50% porosity; 29% total water sat.; Morrow formation: 5 md. perm.; 12% porosity; 30.5% total water sat.; Chester formation: 9 md. perm.; 8% porosity; 25% total water sat. Estimated recovery M.c.f. per acre-ft.: Council Grove 100; Tonkawa 600; Morrow 475; Chester 375.

**MOORE AREA,** Cleveland County.
Pay: Red Fork, Bartlesville. Total depth 8,090 ft.
Costs: Flowing well $109,000. On pump $123,000. Dry hole $53,000. Footage price $4.50. Day-work rate with pipe $650 and without pipe $600.
Rig time: 81% on footage rate. 19% on day-work rate. Total days 46. Total bits 36.
Casing: 10¾-in. surface casing set at 824 ft. with 650 sacks of cement. 5½-in. oil string set at 8,089 ft. with 250 sacks of cement.
Mud: Water-base 5% oil, 807 sacks. Approximate cost $2,475.
Tops: Red Fork at 7,542-53.; Bartlesville 7,672-7,706 ft.
Core data: Estimated recovery: Red Fork 360 bbl. per acre-ft.; Bartlesville 400 bbl. per acre-ft.

**MOORE AREA,** Cleveland County.
Pay: Second Wilcox and Tulip Creek. Total depth 8,020 ft.
Costs: Flowing well (dual completion) $117,000. Pump (dual) $147,000. Dry hole (dual completion) $61,700. Footage price $5. Day-work rate with pipe $750 and without pipe $700.
Rig time: 67% on footage rate. 33% on day-work rate. Total days 76. Total bits 36.
Casing: 10¾-in. surface casing set at 815 ft. with 650 sacks of cement; 7-in. oil string set at 8,020 ft. with 250 sacks of cement.
Mud: Gel, 46 sacks; soda ash, 50 sacks; caustic, 30 sacks.
Tops: Second Wilcox at 7,250 ft.; Tulip


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**MODEL G-226 SKID WINCH FOR SERVICING TO 4000′ OF 2½″ TUBING.**

Weighs hundreds of pounds less, but has the power, brakes and line pull flexibility through the standard 8 speeds to give top performance for swabbing, bailing or pulling rods and tubing on wells which formerly required a heavy machine on a large cumbersome truck for transportation.

Simplified operation requires much less effort by the operator and crew to do the job.

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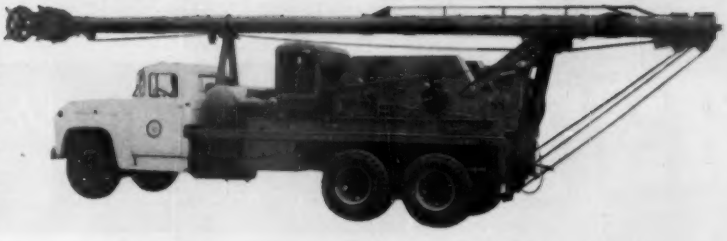
**MODEL P-32 SKID WINCH FOR SERVICING TO 6000′ OF 2½″ TUBING. POWERED BY GASOLINE, L.P.G. OR DIESEL ENGINES UP TO 150 H.P.**

Another in the complete range of machines built by Cooper to fit the job without compromise in performance or unnecessary equipment cost.

Complete selection of auxiliary equipment engineered for the machine.

Available are: Pipe masts, derricks, rotary drives, spudding equipment, catheads, catline guides, dividers, line guide shells.



## ACTIVE FIELDS

Creek at 7,525 ft.; Oil Creek at 7,930 ft.

Core data: Second Wilcox formation: 100 ft. interval; 50 md. perm., 8-10% porosity; 8-12% resid. oil sat.; 25-35% total water sat. Tulip Creek: 10 ft. interval; 25-50 md. perm.; 15% porosity; 8-10% resid. oil sat.; 35-40% total water sat. Oil Creek: 15 ft. interval; 35 md. perm.; 12% porosity; 10-12% resid. oil sat.; 35-40% total water sat.

**NOBLE AREA,** Cleveland County.

Pay: Bromide, Tulip Creek, McLish, and Oil Creek. Total depth 8,995 ft.

Costs: Flowing well (dual completion) $140,000. On pump (dual completion) $170,000. Dry hole $75,000. Footage price $4. Day-work rate $750 plus 1½ cents per foot per day for pipe.

Rig time: 50% on footage rate. 50% on day-work rate. Total days 50. Total bits 46.

Casing: 10¾-in. surface casing set at 859 ft. with 725 sacks of cement. 7-in. oil string set at 8,805 ft. with 525 sacks of cement.

Mud: Barite, 140 sacks; gel, 163 sacks; salt gel, 254 sacks.

Tops: Bromide at 7,950 ft.; Tulip Creek at 8,215 ft.; McLish at 8,350 ft.; Oil Creek at 8,650 ft.

Core data: Bromide formation: 25 ft. interval; 200 md. perm., 10-12% porosity; 8-10% resid. oil sat.; 35% total water sat. Tulip Creek formation: 20 ft. interval; 300 md. perm., 15-18% porosity; 10% resid. oil sat.; 45% total water sat. Oil Creek formation: 30 ft. interval; 100 md. perm.; 12-15% porosity; 10-12% resid. oil sat.; 40% total water sat.

**NORTH BUFFALO,** Harper County.

Pay: Lansing, Kansas City, Oswego and Arbuckle. Total depth 7,750 ft.

Costs: Flowing well $200,000. On pump $225,000. Dry hole $85,000. Footage price $7.25. Day-work rate with pipe $850 and without pipe $800.

Rig time: 80% on footage rate. 20% on day-work rate. Total days 95. Total bits 62.

Casing: 13⅜-in. surface casing set at 530 ft. with 500 sacks of cement. 9⅝-in. intermediate set at 3,250 ft. with 600 sacks of cement. 7-in. oil string set at 7,750 ft. with 550 sacks of cement.

Mud: Gel, 85 tons; cottonseed hulls, 27 tons; soda ash, 5 tons; wood fiber, 17 tons; lignite, 3 tons.

Tops: Lansing at 4,600 ft.; Kansas City at 5,000 ft.; Oswego at 5,400 ft.; Arbuckle at 7,600 ft.

Estimated recovery, bbl. per acre-ft.: Lansing 276 (gas expansion and water drive); Kansas City 384 (gas expansion and water drive); Oswego 200 (gas expansion and water drive); Arbuckle 351 (water drive).

**NORTHEAST CHEYENNE VALLEY,** Major County.

Pay: Cherokee. Total depth 7,250 ft.

Costs: Flowing well $72,000. On pump $82,000. Dry hole $45,000. Footage price $4.40. Day-work rate with pipe $775 and without pipe $725.

Rig time: 87% on footage rate. 13% on day-work rate. Total days 31.

Casing: 9⅝-in. surface casing set at 500 ft. with 250 sacks of cement. 4½-in. oil string set at 7,200 ft. with 180 sacks of cement.

Mud: Bentonite, 4,380 sacks; salt gel, 9,700 sacks; starch, 6,200 lb.; preservative, 600 lb.; cottonseed hulls, 7,600 lb.; fiber, 4,600 lb.

Tops: Cherokee at 7,200 ft.

Core data: Cherokee formation: 35 ft. interval; 5 md. perm., 15% porosity; 13% resid. oil sat.; 35% total water sat. Estimated recovery: 100 bbl. per acre-ft. Gas expansion.

**NORTH OKARCHE,** Kingfisher County.

Pay: Manning. Total depth 8,200 ft.

Costs: Flowing well $112,000. Dry hole $63,000. Footage price $5. Day-work rate with pipe $800 and without pipe $725.

Rig time: 90% footage rate. 10% day-work rate. Total days 36. Total bits 33.

Casing: 10¾-in. surface casing set at 650 ft. with 550 sacks of cement. 5½-in. oil string set at 8,200 ft. with 300 sacks of cement.

Mud: Barite, 75 tons; gel, 75 tons; lignosulfonate, 9,800 lb.; lignite, 10,000 lb.; soda ash, 4,800 lb.; caustic soda, 3,500 lb.; lost circulation material, 180 sacks.

Tops: Layton at 6,750 ft.; Oswego at 7,550 ft.; Manning at 8,130 ft.

Core data: Manning formation: 8,180-90 ft. interval; 11.6 md. perm., 9.4% porosity; 15% total water sat., gas production.

**PAYNE AREA,** McClain County.

Pay: Bromide-Hunton-Hart. Total depth 10,900 ft.

Costs: Flowing well $230,000. Dry hole $100,000. Footage price $6.50. Day-work rate with pipe $950, and without pipe $900.

Rig time: 60% on footage rate. 40% on day-work rate. Total days 90.

Casing: 10¾-in. surface casing set at 800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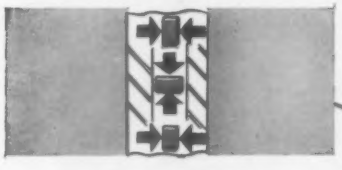
Check over the important features outlined below. You'll find the Shaffer Rotating Blowout Preventer and Stripper ideal for every important drilling requirement!

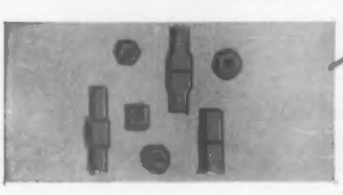


### WEAR-FREE!

The Stripper Rubber rotates with the kelly—not one inside the other. Therefore, flexing and wear are negligible as the drill string rotates. Note that separate thrust and radial bearings (each pre-packed with heat-resisting lubricant) resist any combination of bearing loads!

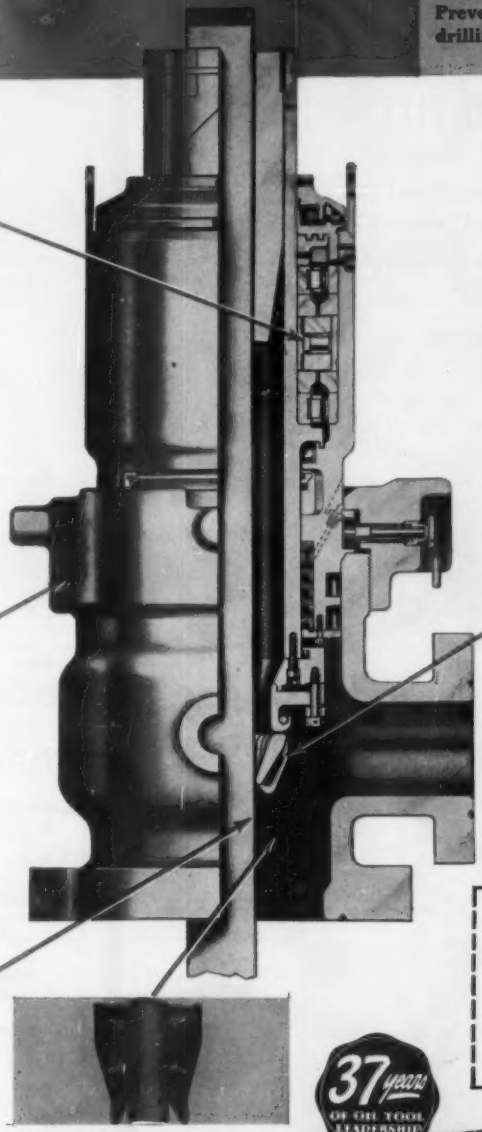
### SIMPLE!

To pass bits, reamers and other abnormally-large diameter tools through the unit, simply lower the tools through the body until the rotating assembly seats in place. Then rotate the bonnet 1/6 turn. This locks the entire internal mechanism in place, to provide a continuous seal against well pressures.



### VERSATILE!

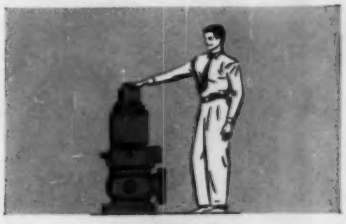
All the varying diameters in the drilling string—drill collars, tool joints, subs and drill pipe (whether upset, flush or coupled)—readily pass through the Stripper Rubber without loss of pressure—and without any manual adjustments. Even the kelly—whether square, hexagon or octagon—is sealed off *automatically!*





### CONTINUOUS!

The Stripper Rubber expands and contracts automatically to fit all normal elements in the drill string (excepting only bits, reamers and similar large diameter tools). No hydraulic, pneumatic or mechanical pressure need be applied. No accessory equipment is required!



### COMPACT!

Unit is amazingly compact in all dimensions—can be installed in unusually "tight" locations. Even flow connections are built-in—no space-wasting spools are required!

### TROUBLE-FREE!

A barrier of flexible steel latches protects the Stripper Rubber against damage while varying diameters pass through the unit. This expandable steel barrier also protects the rubber from extrusion under high well pressures!

*TWO TYPES*—Use the Type 50 for drilling through 10¾" casing and larger... Use the Type 51 for slim hole drilling, production and rework jobs. Both have the same basic features!

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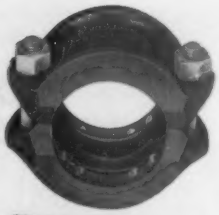

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## ACTIVE FIELDS

ft. with 500 sacks of cement. 7-in. oil string set at 10,000 ft. with 500 sacks of cement.
Mud: Gel, 9.8-lb. Average cost $12,500.
Tops: Hart at 8,500 ft.; Hunton at 9,200 ft.; Bromide 10,000 ft.
Core data: Hart: 1-50 md. perm., 15% porosity. Hunton: 1-20 md. perm., 10% porosity; Bromide: 1-100 md. perm., 17% porosity. Estimated recovery (bbl. per acre-ft.): Hart 125; Hunton 75; Bromide 100. Gas expansion.

**SOUTHEAST MARIETTA,** Love County.
Pay: Oil Creek. Total depth 14,600 ft.
Costs: Flowing well $504,000. Dry hole $400,000. Footage price $14.50. Day-work rate with pipe $1,450, and without pipe $1,200.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 145. Total bits 121.
Casing: 13⅜-in. surface casing set at 1,300 ft. with 800 sacks of cement. 9⅝-in. intermediate set at 11,000 ft. with 600 sacks of cement. 5½-in. oil string set at 14,000 ft. with 500 sacks of cement.
Mud: Gel, 3,350 sacks; barite, 5,500 sacks; lignite, 1,150 sacks; oil, 700 bbl.
Tops: Deese at 4,800 ft.; Viola at 10,800 ft.; Bromide at 11,900 ft.; Oil Creek at 14,000 ft.

**SHATTUCK AREA,** Ellis County.
Pay: Morrow. Total depth 10,000 ft.
Costs: Flowing well $160,000. Dry hole $90,000. Footage price $5. Day-work rate with pipe $950 and without pipe $850.
Rig time: 50% on footage rate. 50% on day-work rate. Total days 49. Total bits 39.
Casing: 20-in. surface casing conductor set at approximately 40 ft. with 4 yd. 8⅝-in. or 9⅝-in. intermediate set at 3,700 ft. with 200 sacks of cement at bottom; 300 sacks at stage tool. 4½ or 5½-in. oil string set at 10,000 ft. with 150-200 sacks of cement.
Mud: O-Intermediate casing point, natural. Intermediate casing point—TD, gel chemical with oil and lost-circulation material added as required. Average cost of mud and oil, 90 cents per foot.
Tops: Morrow at 9,300 ft.; Mississippian at 10,000.

**SHO-VEL-TUM,** Stephens County.
Pay: Oil Creek-McLish. Total depth 8,100 ft.
Costs: Flowing well $125,000. On pump $131,000. Dry hole $75,000. Footage price $5. Day-work rate with pipe $700; without pipe $600.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 70. Total bits 50.
Casing: 10¾-in. surface casing set at 314 ft. with 275 sacks of cement. 7-in. oil string set at 6,258 ft. with 250 sacks of cement. 5½-in. set at 6,190 ft. with 300 sacks of cement. Liner to 7,999 ft.
Mud: Gel, 60,000 lb.; lignite, 5,000 lb.; barite, 5,000 lb.
Tops: Fusilina at 3,389 ft.; Tussy at 3,712 ft.; Woodford at 4,226 ft.; Sylvan at 5,020 ft.; McLish at 7,600 ft.; Oil Creek at 7,800 ft.

**SOUTHWEST KINGFISHER,** Kingfisher County.
Pay: Manning and Cottage Grove. Total depth 8,200 ft.
Costs: Flowing well $102,000. Dry hole $60,000. Footage price $4.75. Day-work

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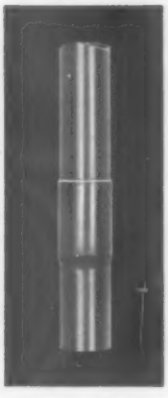

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## ACTIVE FIELDS

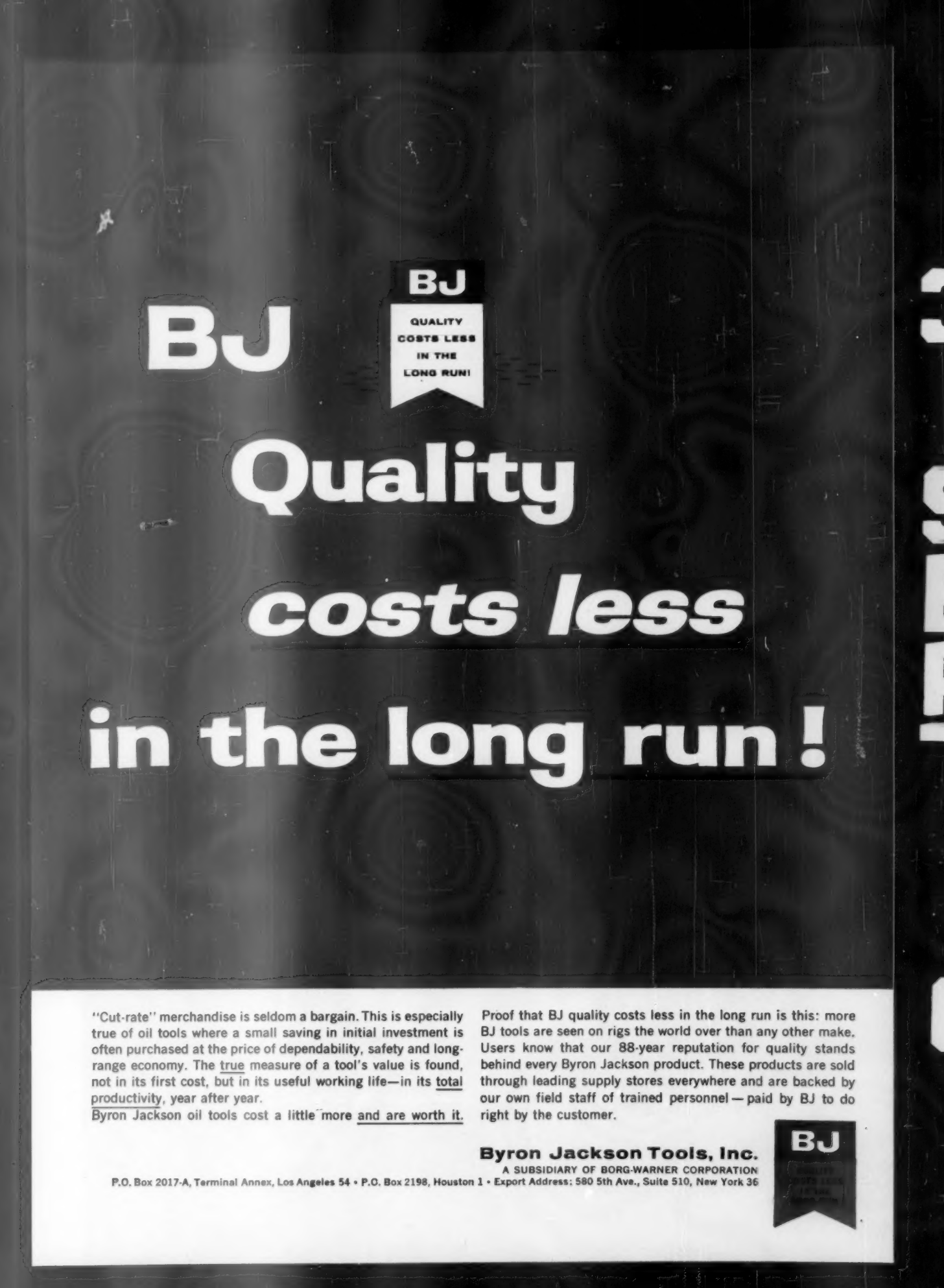
rate with pipe $825 and without pipe $750.
Rig time: 96% on footage rate. 4% on day-work rate. Total days 35.
Casing: 8⅝-in. surface casing set at 492 ft. with 500 sacks of cement. 4½-in. oil string set at 8,188 ft. with 300 sacks of cement. In some areas 5½-in. oil string.
Mud: Fresh water; gel mud (cost approximately $5,000).
Tops: Cottage Grove at 6,400 ft.; Oswego at 7,500 ft.; Manning at 7,950 ft.
Core data: Manning at 8,025-44 ft. interval; 0.1 to 2.7 md. perm., ave. 11% porosity; ave. 16% total water sat.
NOTE: Cable-tool completion required 9 days additional rig time.

**VALLEY CENTER,** Dewey County.
Pay: Tonkawa and Oswego. Total depth 9,700 ft.
Costs: Flowing well $190,000. On pump $215,000. Dry hole $115,000. Footage price $5.50. Day-work rate with pipe $900 and without pipe $800.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 48. Total bits 45.
Casing: 13⅜-in. surface casing set at 520 ft. with 500 sacks of cement. 9⅝-in. intermediate set at 3,900 ft. with 600 sacks of cement. 5½-in. oil string set at 9,700 ft. with 500 sacks of cement.
Mud: Gel, 70 tons; cottonseed hulls, 19 tons; soda ash, 2 tons; fiber, 2 tons; caustic soda, 3 tons.
Tops: Tonkawa at 7,500 ft., and Oswego at 9,200 ft.
Estimated recovery bbl. per acre-ft. (gas expansion): Tonkawa 1,042 M.c.f.; Oswego 1,371 M.c.f.

## East Texas

**EAST LINDEN,** Cass County.
Pay: 9,864-74; 10,254-83; 10,620-63 ft.
Costs: Flowing well $300,000. On pump $320,000. Dry hole $225,000. Footage price $11. Day-work rate with pipe $900 and without pipe $700.
Rig time: 66% on footage rate. 34% on day-work rate. Total days 120. Total bits 120.
Casing: 13⅜-in. surface casing set at 392 ft. with 515 sacks of cement. 9⅝-in. intermediate set at 3,946 ft. with 846 sacks of cement. 7-in. oil string set at 10,836 ft. Used nonfluorescent oil.
Mud: Natural, bentonite and oil emulsion-low solids.
Tops: Base Massive Anhydrite at 5,778 ft.; top Pettit at 6,568 ft.; top Cotton Valley at 8,220 ft.; top Cotton Valley lime at 10,267 ft.; top Smackover at 10,725 ft.

**HAYNES,** Cass County.
Pay: Henderson "A," Mitchell. Total depth 6,000 ft.
Costs: Flowing well $30,000. On pump $90,000. Dry hole $20,000. Footage price $4. Day-work rate with pipe $650 and without pipe $600.
Rig time: 86% on footage rate. 14% on day-work rate. Total days 24. Total bits 12.
Casing: 9⅝-in. surface casing set at 700 ft. with 300 sacks of cement. 5½-in. oil string set at 6,092 ft. with 200 sacks of cement.
Mud: Bentonite, 56 sacks; lime, 5 sacks; caustic soda, 41 sacks; quebracho, 50 sacks; lignosufonate, 58 sacks; CMC, 7 sacks.

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## ACTIVE FIELDS

Tops: Hill at 5,945 ft.; Henderson "A" at 6,000 ft.; Mitchell at 6,020 ft.

Core data: Hill formation: 7 ft. interval; 29 md. perm., 18% porosity; 16% resid. oil sat.; 45% total water sat. Henderson "A": 6 ft. interval; 10 md. perm.; 13.6% porosity; 15% resid. oil sat.; 35% total water sat. Mitchell: 8 ft. interval; 15 md. perm., 16% porosity; 15% resid. oil sat. 35% total water sat.

Estimated recovery: bbl. per acre-ft. (gas expansion): Hill 136; Henderson "A" 100; Mitchell 125.

**NEW HOPE,** Franklin County.

Pay: Smackover lime. Total depth 12,400 ft.

Costs: Flowing well $380,000. Footage price $11. Day-work rate with pipe $1,050 and without pipe $900.

Rig time: 90% on footage rate. 10% on day-work rate. Total days 90. Total bits 90.

Casing: 13⅜-in. surface casing set at 900 ft. with 650 sacks of cement. 9⅝-in. intermediate set at 8,400 ft. with 1,100 sacks of cement. 7-in. oil string set at 12,400 ft. with 500 sacks of cement.

Mud: gypsum, 35 sacks; lignosulfonate, 765 sacks; caustic, 15,500 lb.; gel, 801 sacks; oil, 550 bbl.

Tops: Rodessa at 7,300 ft.; Travis Peak at 8,000 ft.; Cotton Valley at 9,300 ft.; Buckner Anhydrite 11,500 ft.

**SOUTHEAST FRUITVILLE,** Van Zandt County.

Pay: Cotton Valley, James, and Rodessa. Total depth 13,000 ft.

Costs: Flowing $320,000. Dry hole $250,000. Footage price $12. Day-work rate with pipe $1,150 and without pipe $950.

Rig time: 85% footage rate. 15% day-work rate. Total days 160. Total bits 140.

Casing: 13⅜-in. surface casing set at 120 ft. 9⅝-in. intermediate set at 5,228 ft.; 7-in. oil string set at 12,096 ft.

Mud: Native mud; native mud and bentonite; 5,300-7,000 ft. gel chemical mud; 7,000-ft. TD, or top salt-gyp. base.

Tops: Massive anhydrite at 7,700 ft.; Rodessa at 8,100 ft.; Travis Peak at 8,700 ft.; Cotton Valley at 9,900 ft.; Salt 12,000.

**WRIGHT MOUNTAIN,** Smith County.

Pay: Pettet. Total depth 8,500 ft.

Costs: Flowing well $85,000. Dry hole $59,000. Footage price $3.90. Day-work rate with pipe $650 and without pipe $550.

Rig time: 80% on footage rate. 20% on day-work rate. Total days 50. Total bits 27.

Casing: 8⅝-in. surface casing set at 1,440 ft. with 375 sacks of cement. 5½-in. oil string set at 8,435 ft. with 350 sacks of cement.

Mud: Depth 4,000-7,000, weight 9-8 to 10; viscosity 34-36 cc.; water loss 10-15 cc. Depth 7,000-8,500 weight 10 to 10.3 viscosity 38-42 cc.; water loss 8-12 cc.

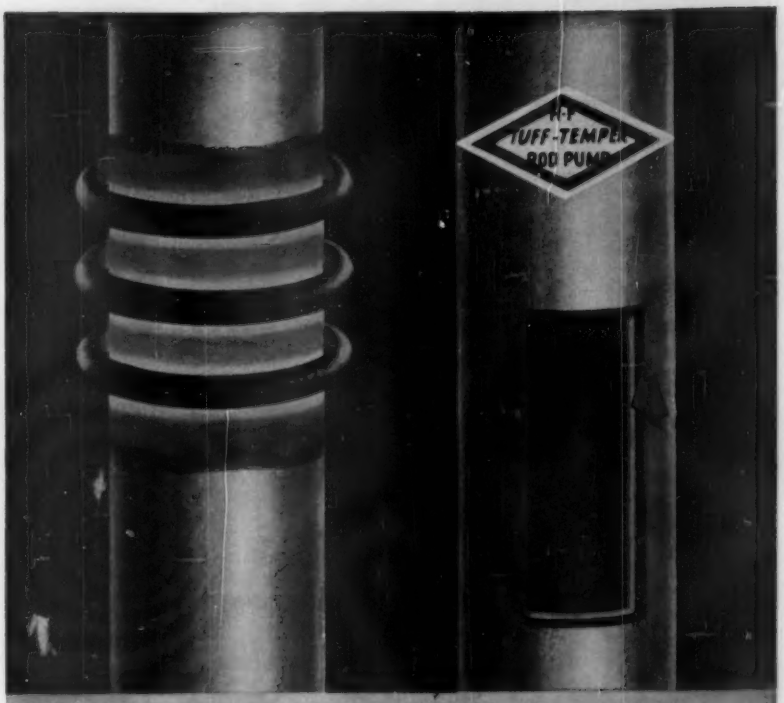
Tops: Glen Rose at 5,930 ft.; Massive Anhydrite at 7,286 ft.; Pettet 8,194 ft.; Travis Peak at 8,416 ft.

Core data: Pettet formation: 6 ft. interval; 4.1 md. perm., 12.8% porosity; 14.3% resid. oil sat.; 12.4% total water sat. Estimated recovery: bbl. per acre ft. (gas expansion): Pettet 117.

## North Texas

**BOONESVILLE,** Wise County.

Pay: Bend conglomerate. Total depth 6,200 ft.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For the longest and most dependable service from a sub-surface pump running in abrasive fluids, your best choice is a barrel tube with a hardened wearing surface. From that point on, the rest is easy: Run a Tuff-Temper pump — the Best Pump in the Oil Patch to resist the abrasive effects of sand, scale, etc., that would cause undue wear and shorten the life of the pump.

Electronics puts the toughness and the temper in Tuff-Temper barrel tubes — where the wear-resisting properties are most needed. Each tube is heat treated by high-frequency induction hardening machines, the latest and surest method for exact control of temperature for uniform hardness and dense grain structure. The hard wearing surface produced by this method extends to a depth of 1/32", and the outer portion remains ductile and shock-resistant.

After the induction hardening process, the tubes are straightened on special machines, the inside working surface is expertly honed and polished to a mirror finish, and each barrel is checked against a full set of A.P.I. gauges. Heavy-duty pumps for deep-well production and chrome-plated plungers for extra hard wear can be furnished if desired.

Leading stores carry Tuff-Temper rod and tubing pumps in a wide range of A.P.I. types and sizes. You can obtain complete details and illustrated literature from your own store, one of our many factory warehouses or field representatives, or by writing to us at P. O. Box 2477 in Fort Worth. There is no obligation, of course.

H-F

"BEST PUMPS IN THE OIL PATCH"

**HARBISON-FISCHER MFG. CO.**

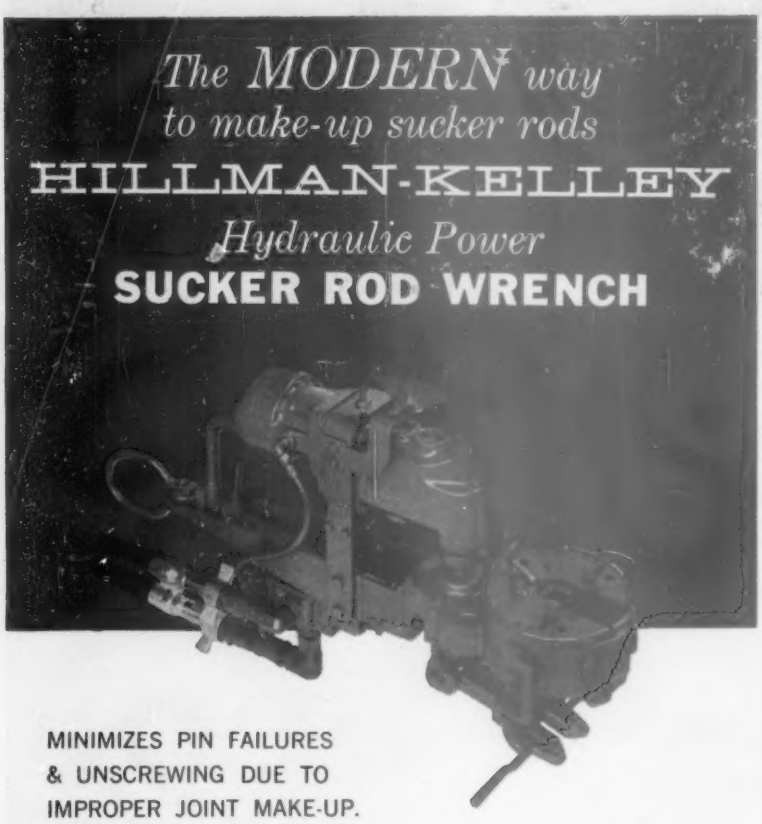
**FORT WORTH**

## ACTIVE FIELDS

Costs: Flowing well $65,000. Footage price $4.25. Day-work rate with pipe $750 and without pipe $700.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 25. Total bits 25.
Casing: 8⅝-in. surface casing set at 400 ft. with 250 sacks of cement. 4½ and 5½-in. oil string set at 6,200 ft. with 200 to 400 sacks of cement.
Mud: Gel, 800 sacks; oil, 300 bbl.
Tops: Caddo at 4,000 ft.; Bend at 6,000 ft., gas production.

**NEW MAG—OIL CREEK,** Grayson County.

Pay: Basal Oil Creek sand. Total depth 13,000 ft.
Costs: Flowing well $440,000. Dry hole $330,000. Footage price $13.90. Day-work rate with pipe $1,150, and without pipe $950.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 140. Total bits 129.
Casing: 13⅜-in. surface casing set at 1,400 ft. with 800 sacks of cement. 9⅝-in. intermediate set at 10,000 ft. with 600 sacks of cement. 5½-in. oil string set at 13,300 ft. with 600 sacks of cement.
Mud: Gel, 2,800 sacks; barite, 4,500 sacks; lignite, 900 sacks; oil, 1,000 bbl.
Tops: Atoka at 8,000 ft.; Viola at 9,800 ft.; Bromide at 10,800 ft.; Oil Creek sand at 12,900 ft.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## South Texas

**LOPENO,** Zapata County.
Pay: 9,100 ft. sand. Total depth 12,349 ft.
Costs: Flowing well $510,000. Day-work rate with pipe $900 plus 1½c per ft.; without pipe $900.
Rig time: 100% on day-work rate. Total days 199. Total bits 104.
Casing: 13⅜-in. surface casing set at 993 ft. with 550 sacks of cement. 9⅝-in. intermediate set at 7,015 ft. with 600 sacks of cement. 5½-in. oil string set at 10,387 ft. with 700 sacks of cement.
Mud: Material: Gel-clay, quebracho, CMC,, and high-pH lime mud.
Tops: Sparta at 1,605 ft.; Queen City at 2,190 ft.; Wilcox at 6,700 ft.
Core data: Wilcox formation: 9,130-60 ft. interval; 1-6 md. perm.; 11-25% porosity; 50-86% total water sat.

**PALACIOS AREA,** Matagorda and Calhoun counties.
Pay: E-3 and E-4. Total depth 9,050 ft.
Costs: Flowing well $96,000. Dry hole $75,000. Footage price $2.85. Day-work rate with pipe $875, and without pipe $800.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 22. Total bits 9.
Casing: 9⅝-in. surface casing set at 1,000 ft. with 250 sacks of cement (8% gel). 5½-in. oil string set at 9,050 ft. with 350 sacks of cement (4% gel).
Mud: Reclaimed natural mud treated with 8% oil emulsion has been used exclusively.
Tops: E-3 at 8,990 ft.; E-4 at 9,010 ft.

**PERSON,** Karnes County.
Pay: Edwards. Total depth 11,000 ft.
Costs: Flowing well $175,000. Dry hole $90,000. Footage price $4. Day-work rate with pipe $1,000 and without pipe $900.
Rig time: 79% on footage rate. 21% on day-work rate. Total days 48. Total bits 25.
Casing: 9⅝-in. surface casing set at 1,800 ft. with 700 sacks of cement. 5½-in. oil string set at 11,000 ft. with 380 sacks of cement.
Mud: Low lime-oil emulsion, 3,000 sacks.
Tops: Edwards at 10,780 ft.

**PORT ARTHUR-PORT ACRES,** Jefferson County.
Pay: Lower Hackberry-Nordosaria. Total depth 12,000 ft.
Costs: Flowing well $270,000. Dry hole $200,000. Footage price $3.75. Day-work rate with drill pipe $1,200, and without pipe $1,100.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 50. Total bits 20.
Casing: 13⅜-in. surface casing set at 2,500 ft. with 2,000 sacks of cement. 7⅝-in. intermediate pipe set at 10,400 ft. with 1,000 sacks of cement. 5½-in. liner set with 1,200 sacks of cement.
Mud: Weight of mud to 10,700 ft. was 13 lb.; 17-lb. mud to T.D.
Tops: Upper Frio sand at 8,000 ft.; Lower Hackberry at 10,600 to 11,000 ft.
Core data: Hackberry; 200 md. permeability; 30% porosity; 2% resid. oil sat.; 60% total water sat.

**RED FISH REEF, SOUTH,** Chambers County.
Pay: Frio 11,325 ft. Total depth 11,400 ft.
Costs: Footage price $5.75. Day-work rate

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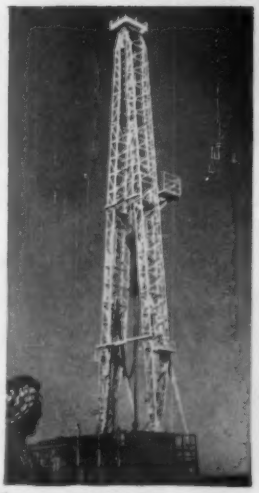

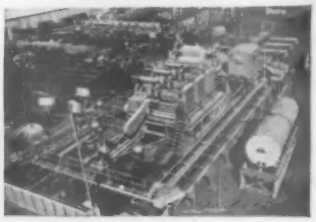

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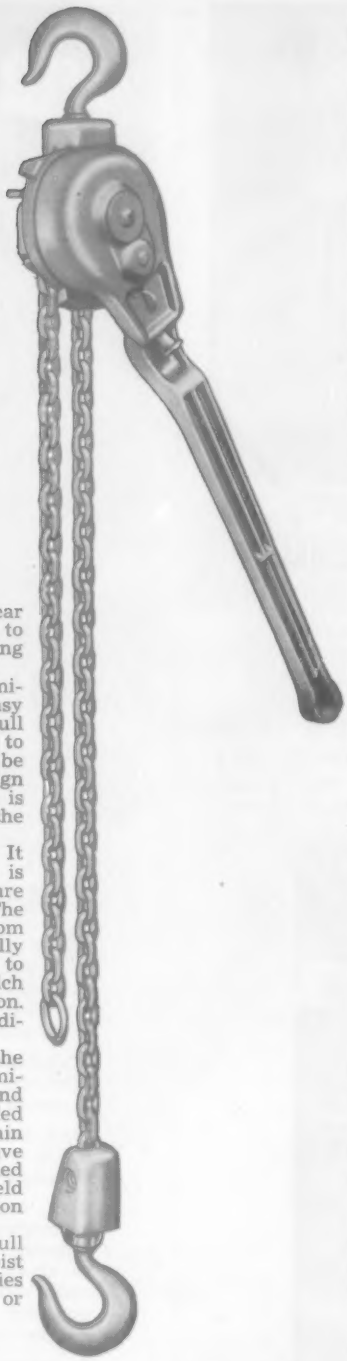
# Again Coffing Brings You a New Line of Hoists



For the second time in less than a year Coffing has introduced a new hoist line to give you easy, safe, positive efficient lifting power at moderate cost.

The new RA Series Safety Pull Aluminum Ratchet and Pawl Lever Hoist is easy to operate—requires minimum handle pull—only 59 pounds for the ¾-ton model to 97 pounds for the 6-ton model. It may be operated from either side and the design prevents freezing a load. Load rotation is easy because of ball thrust bearings in the load hook assembly.

Safety has been built into the hoist. It will not ratchet under load if handle is released nor will it free chain. Controls are protected from inadvertant shifting. The bottom stop eliminates any hazard from the handle being released unintentionally and prevents handle from being moved to a position parallel to the load chain which would develop undesirable twisting action. The exclusive safety handle bends to indicated overload.

Strength without excess weight in the new hoist is achieved by a special aluminum alloy which is used in the body and handle. Long service life has been provided by the high tensile material in the chain retaining guide, heat treated load sheave and the plated, high tensile, heat treated alloy steel link chain. Maintenance is held to a minimum by the rugged construction and simplicity of design.

The new Coffing RA Series Safety Pull Aluminum Ratchet and Pawl Lever Hoist is available in six models with capacities from ¾ to 6 tons. Ask your supply store or write for Bulletin ADH-86.

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## ACTIVE FIELDS

with pipe $1,250, and without pipe $1,150.

Rig time: 80% on footage rate. 20% on day-work rate. Total days 40. Total bits 28.

Casing: 13⅜-in.surface casing set at 200 ft. with 220 sacks of cement. 9⅝-in. intermediate set at 2,000 ft. with 550 sacks of cement. 5½-in. oil string set at 11,400 ft. with 500 sacks of cement.

Mud: Bentonite, 15 sacks; barite, 2,500 sacks; caustic, 10,400 lb.; quebracho, 9,000 lb.; phosphate, 1,030 lb.; gyp, 32,000 lb.; lignosulfonate, 16,000 lb.; oil, 19,000 gal.

Tops: Frio: (F-1) at 9,096 ft.; (F-5) at 9,875 ft.; (F-9) at 10,400 ft.; (F-13) at 11,000 ft.; (F-15) at 11,325 ft.

**THEUVENINS CREEK,** Tyler County.

Pay: 8,400 and 8,500 ft. Wilcox. Total depth 8,610 ft.

Costs: Flowing well (dual completion) $110,000; (single completion) 90,000. Dry hole $60,000. Footage price $2.65. Day-work rate with pipe $750, and without pipe $700.

Rig time: 66% on footage rate. 34% on day-work rate. Total days 33. Total bits 12.

Casing: 10¾-in. surface casing set at 1,727 ft. with 533 sacks of cement plus 50% startacrete. 7-in. oil string set at 8,565 ft. with 276 sacks of cement.

Mud: Barite, 1,203 sacks; gel, 70 sacks; lime, 3 sacks; caustic, 44 cans; quebracho, 4 sacks; tetraphosphate, 35 sacks; lignosulfonate, 39 sacks; emulsifier, 32 sacks; CMC, 32 sacks, thinners, 30 sacks; diesel oil, 5,860 gal.

Tops: Wilcox at 8,440 ft. and at 8,480 ft.

Core data: Wilcox, 8,445-60 ft. interval; 750 md. perm.; 19% porosity; 7% resid. oil sat. 35% total water sat. Wilcox, 8,485-95 ft. interval; 1,000 md. perm.; 18% porosity; 6% resid. oil sat.; 30% total water sat. Estimated recovery in bbl. per acre-ft. (gas expansion): 150.

## West Texas

**BAKKE,** Andrews County.

Pay: Clearfork, Wolfcamp, Pennsylvanian, Devonian, and Ellenburger. Total depth 12,500 ft.

Costs: Flowing well $180,000 in Pennsylvanian and $320,000 in Ellenburger. Footage price $8.75 to 12,500 ft. Day-work rate with pipe $1,050, and without pipe $950.

Rig time: 96% on footage rate. 4% on day-work rate. Total days 90. Total bits 65.

Casing: 13⅜-in. surface casing set at 200 ft. with 275 sacks of cement. 9⅝-in. intermediate set at 4,800 ft. with 2,200 sacks of cement. 7 or 5½-in. oil string set at 12,500 ft. with 800 sacks of cement.

Mud: Salt-gel, 50 sacks; bentonite, 800-1,200 sacks; CMC, 100 sacks; diesel oil, 300 bbl.

Tops: San Andres at 4,400 ft.; Wolfcamp at 8,500 ft.; Pennsylvanian at 9,000 ft.; Devonian at 10,500 ft.; Ellenburger at 12,300 ft.

Core data: Wolfcamp, 8,500-8,600 ft. interval; 62 md. perm.; 11% porosity; 12% resid. oil sat.; 38% total water sat. Pennsylvanian, 9,000-9,200 ft. interval, 20 md. perm.; 8% porosity; 8% resid. oil sat.; 46% total water sat. Ellenburger, 12,300-12,500 ft. interval; 2 (frac) md. perm.; 2.7% porosity; 11% resid. oil sat.; 45% total water sat.

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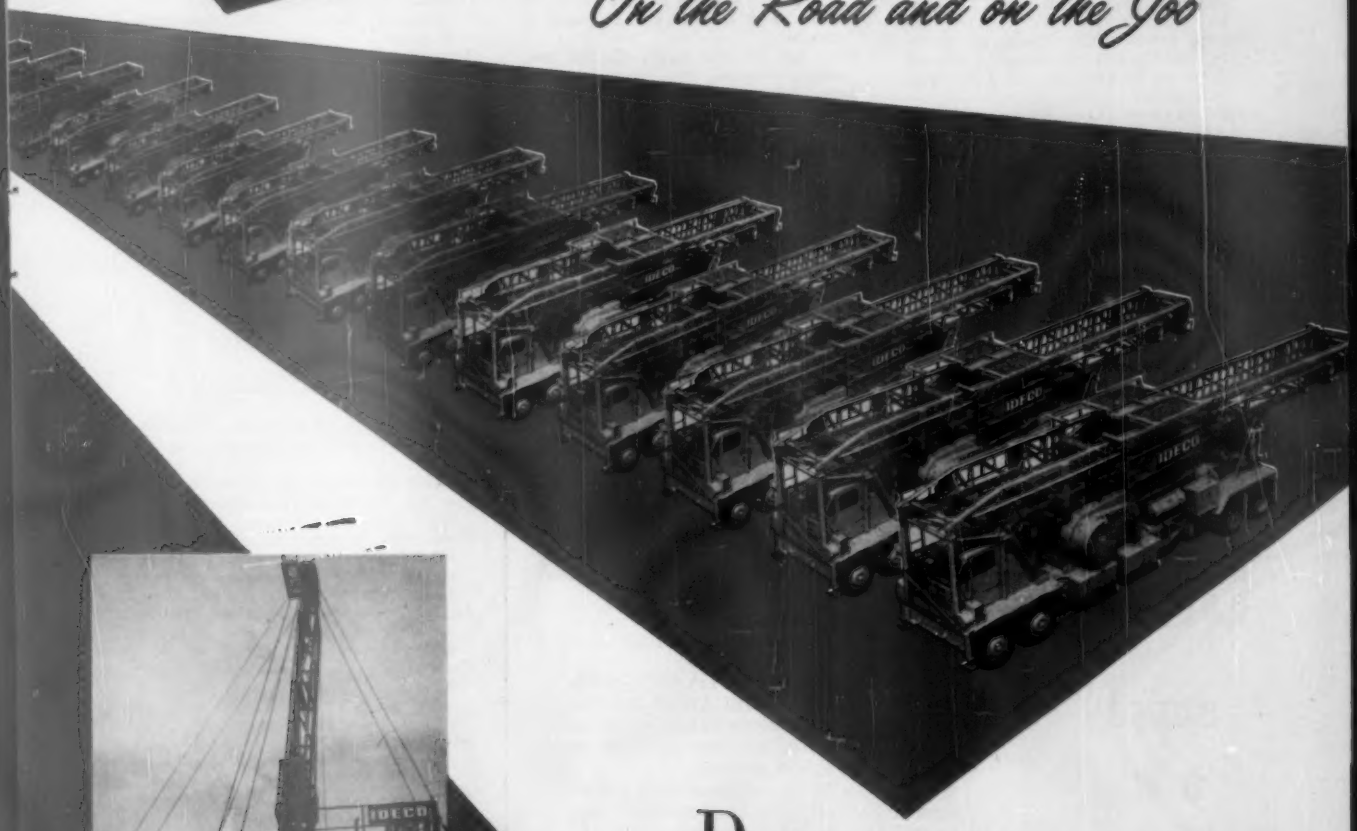

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## ACTIVE FIELDS

**DUNE,** Crane County.
Pay: Grayburg and San Andres. Total depth, 4,000 ft.
Costs: Flowing well $43,000. On pump $52,300. Dry hole $32,000. Footage price $2.55. Day-work rate with pipe $600, and without pipe $550.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 8. Total bits 10.
Casing: 8⅝-in. surface casing set at 900 ft. with 125 sacks of cement. 5½-in. oil string set at 4,200 ft. with 1,250 sacks of cement.
Mud: Bentonite, 4,000 lb.; salt-water clay, 3,200 lb.; starch, 1,750 lb., hydrated lime, 250 lb.
Tops: Rustler anyhdrite 1,100 ft.; Grayburg 3,000 ft.; San Andres 3,170 ft.

**FOSTER,** Ector County.
Pay: Grayburg. Total depth 4,250 ft.
Costs: Flowing well $45,000. On pump $55,000. Dry hole $30,000. Footage price $3. Day-work rate with pipe $650, and without pipe $600.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 8. Total bits 10.
Casing: 8⅝-in. surface casing set at 250 ft. with 175 sacks of cement. 5½-in. oil string set at 4,250 ft. with 200 sacks of cement.
Mud: Salt gel, 120 sacks; oil, 100 bbl.; starch, 20 sacks.
Tops: Red beds at 90 ft.; Grayburg at 3,940 ft.

**FULLERTON,** Andrews County.
Pay: Clearfork. Total depth 7,223 ft.
Costs: Flowing well $81,200. Footage price $4.50. Day-work rate with pipe $775, and without pipe $725.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 20. Total bits 24.
Casing: 8⅝-in. surface casing set at 1,804 ft. with 680 sacks of cement. 4½-in. oil string set at 7,222 ft. with 540 sacks of cement.
Mud: Sodium soap, 27 sacks, oil, 270 bbl.; starch, 25 sacks; gel 15 sacks; lost-circulation material (fiber, mud seal), 25 sacks.
Tops: San Andres at 4,442 ft.; Glorieta at 5,595 ft.; Clearfork at 6,152 ft.; Tubb (Lower Clearwork) at 6,708 ft. (54-ft. thick, net).

**GOLDSMITH,** Ector County.
Pay: Grayburg, Total depth 4,700 ft.
Costs: Flowing well $41,600. On pump $52,000. Dry hole $38,400. Footage price $3.50. Day-work with pipe $675, and without pipe $600.
Rig time: 95% on footage rate. 5% on day-work rate. Total days 19.
Casing: 8⅝-in. surface casing set at 250 ft. with 210 sacks of cement. 4½-in. oil string set at 4,700 ft. with 1,250 sacks of cement.
Mud: Bentonite, surface to 250 ft. Brine and drilling-soap compound 250 ft. to TD.
Tops: Grayburg at 4,370 ft.; Correlative lime at 4,490 ft.; top pay at 4,560 ft.

**HOWARD GLASSCOCK,** Howard County.
Pay: San Andres and San Angelo. Total depth 3,000 ft.
Costs: Well on pump $30,000. Dry hole $11,000. Footage price $2.80. Day-work rate with pipe $550, and without pipe $500.
Rig time: 98% on footage rate. 2% on day-work rate. Total days 9. Total bits 8.
Casing: 8⅝-in. surface casing set at 160 ft. with 150 sacks of cement. 5½-in. oil string set at TD with 75 sacks of cement. Using 4½-in. also.
Mud: Water to 2,000 ft. Gel, starch, and preservative. Mud cost is $1,500 to $2,000.
Tops: Yates at 1,250 ft.; San Andres at 2,000 ft., San Angelo at 2,800 ft.
Core data: San Andres, 2,170-2,286 ft. interval; 0.9 md. perm.; 10.5% porosity; 10% resid. oil sat. 61.3% total water sat. San Angelo, 2,822-40 ft. interval; 0.6 md. perm.; 15.9% porosity; 18.4% resid. oil sat. 51.7% total water sat. Estimated recovery in bbl. per acre-ft. (gas expansion or water drive): San Andres 50 (gas); 191 (water). San Angelo 102 (gas); 295 (water).

**McELROY,** Crane County.
Pay: Greenburg. Total depth 3,100 ft.
Costs: Flowing well $41,000. On pump $47,000. Dry hole $20,000. Footage price $3.50. Day-work rate with drill pipe $650, and without pipe $400.
Rig time: 97% on footage rate. 3% on day-work rate. Total days 7. Total bits 11.
Casing: 8⅝-in. surface casing set at 550 ft. with 350 sacks of cement. 5½-in. oil string set at 3,100 ft. with 1,000 sacks of cement.
Mud: Gel, 75 sacks; starch, 50 sacks. Note: Spud mud for surface and clear water to 2,700 ft. Through pay zone, starch, salt gel, and oil were used.
Tops: Yates at 7,000 ft.; Grayburg at 7,950 ft.

**NORTH COWDEN,** Ector County.
Pay: Grayburg. Total depth 4,700 ft.
Costs: Flowing well $36,000. On pump

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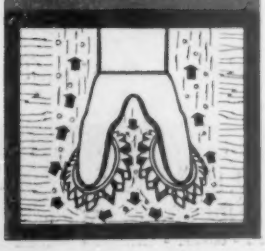

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## ACTIVE FIELDS

$48,000. Dry hole $33,000. Footage price $3.25. Day-work rate with pipe $750, and without pipe $675.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 9. Total bits 16.
Casing: 8⅝-in. surface casing set at 215 ft. with 200 sacks of cement. 4½-in. oil string set at 4,700 ft. with 1,200 sacks of cement.
Mud: Bentonite and lime. Fresh water becoming salt saturated.
Tops: Brown lime at 4,000 ft.; Grayburg at 4,350 ft.

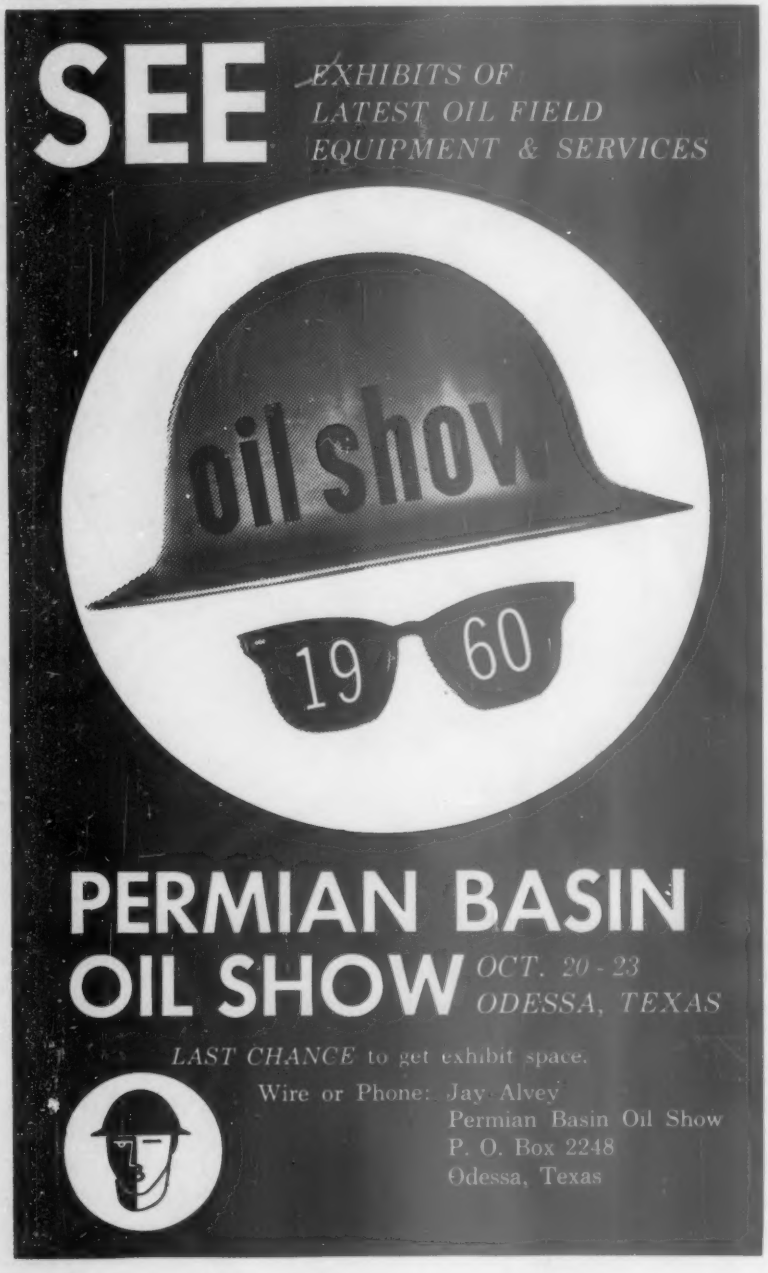
**PENWELL,** Ector County.
Pay: San Andres. Total depth 3,800 ft.
Costs: Flowing well $45,000. On pump $55,000. Dry hole $19,000. Footage price $2.80. Day-work rate with pipe $625, and without pipe $550.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 8. Total bits 10.
Casing: 8⅝-in. surface casing set at 750 ft. with 400 sacks of cement. 5½-in. oil string at 3,800 ft. with 900 sacks of cement.
Mud: Fresh water gel and oil emulsion, 100 sacks.
Tops: Yates at 2,100 ft.; Grayburg at 3,100 ft.; San Andres at 3,500 ft.
Core data: San Andres, 3,545-91 ft. interval; 1.4 md. perm., 6.8% porosity; 7.7% resid. oil sat.; 66.5% total water sat. San Andres, 3,575-3,797 ft. interval; 1.9 md. perm.; 5.9% porosity; 9% resid. oil sat.; 67.6% total water sat. San Andres, 3,636-88 ft. interval, 0.8 md. perm.; 5.8% porosity; 9.6% resid. oil sat.; 60.1% total water sat. Estimated recovery in bbl. per acre-ft. (gas expansion): San Andres 3,545-91 ft., 58; San Andres 3,575-3,797, 35; San Andres 3,636-88, 46.

**PUCKETT,** Pecos County.
Pay: Devonian (gas). Total depth 10,800 ft.
Costs: Flowing $300,000. Dry hole $200,000. Footage price $9.60. Day-work rate with pipe $1,050, and without pipe $950.
Rig time: 85% on footage rate. 15% on day-work rate. Total days 84. Total bits 72.
Casing: 13⅜-in. surface casing set at 1,250 ft. with 900 sacks of cement. 9⅝-in. intermediate at 6,000 ft. with 1,400 sacks of cement. 5½-in. oil string set at 10,800 ft. with 2,000 sacks of cement.
Mud: Gel and hulls, 2,000 sacks; salt mud, 150 sacks.
Tops: Devonian at 10,500 ft.

**SHIPLEY-QUEEN,** Ward County.
Pay: Queen sand. Total depth 2,750 ft.
Costs: Flowing well $29,800. On pump $37,300. Dry hole $12,200. Footage price $2.85. Day-work rate with pipe $525, and without pipe $500.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 9. Total bits 12.
Casing: 8⅝-in. surface casing set at 250 ft. with 150 sacks of cement. 5½-in. oil string at 2,600 ft. with 100 sacks of cement.
Mud: Fresh-water gel and oil emulsion, 100 sacks.
Tops: Yates at 1,970 ft.; Queen at 2,440 ft.
Core data: Queen, 2,610-38 ft. interval; 20 md. perm.; 19% porosity; 10% resid. oil sat.; 50% total water sat. Estimated recovery, bbl. per acre-ft.:135.

**TXL-TUBB,** Ector County.
Pay: Tubb sand. Total depth 6,600 ft.
Costs: Flowing well $68,000. On pump $80,000. Dry hole $41,000. Footage price $4.75. Day-work rate with pipe $675, and without pipe $625.
Rig time: 83% on footage rate. 17% on day-work rate. Total days 28. Total bits 26.
Casing: 9⅝-in. surface casing set at 1,500 ft. with 400 sacks of cement. 5½-in. oil string at 6,600 ft. with 200 sacks of cement.
Mud: Gel, 80 sacks; starch, 55 sacks; crude oil, 200 bbl.; emulsifier, 87 sacks.
Tops: Red Bed at 90-1,000 ft.; San Andres at 4,110 ft.; Clorietta at 5,150 ft.; Clearfork at 5,474 ft.; Tubb at 6,022 ft.

**TXL-WOLFCAMP (NORTH),** Ector County.
Pay: 7,550-ft. Wilcox. Total depth 7,780.
Costs: Flowing well $107,000. On pump $120,000. Dry hole $85,000. Footage price $5.75. Day-work with pipe $700, and without pipe $600.
Rig time: 98% on footage rate. 2% on day-work rate. Total days 31. Total bits 34.
Casing: 8⅝-in. surface casing set at 1,401 ft. with 505 sacks of cement. 4½-in. oil string at 7,780 ft. with 705 sacks of cement.
Mud: Bentonite, 23 sacks; mud seal, 29 sacks; CMC, 1,250 lb.; crude oil, 194 bbl.; brine water, 2,680 bbl.
Tops: San Andres at 4,078 ft.; Upper Clearfork at 5,455 ft.; Tubb at 6,020 ft.; Wolfcamp at 7,556.

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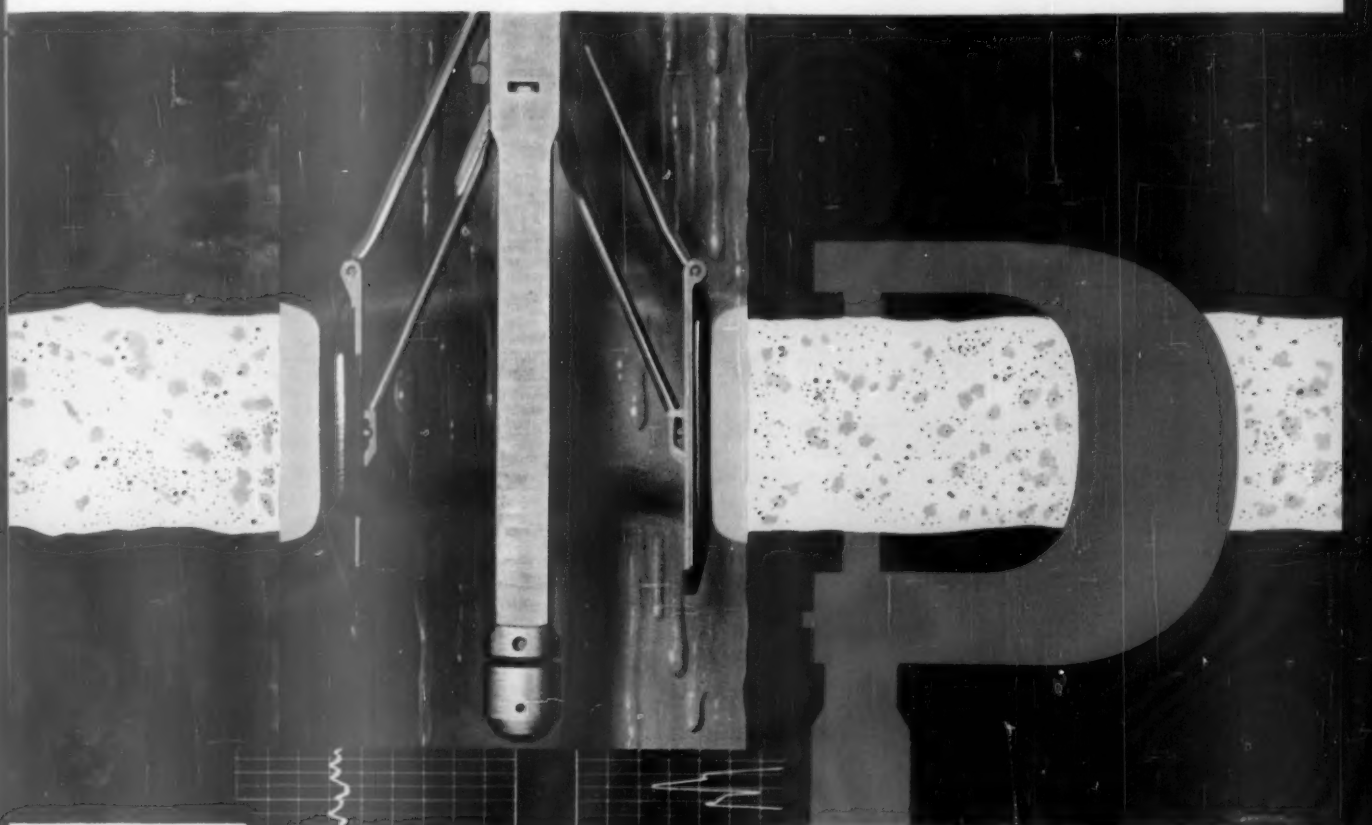

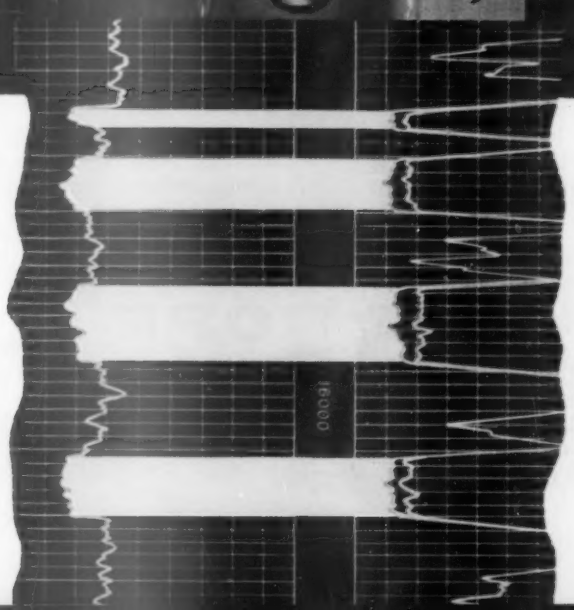

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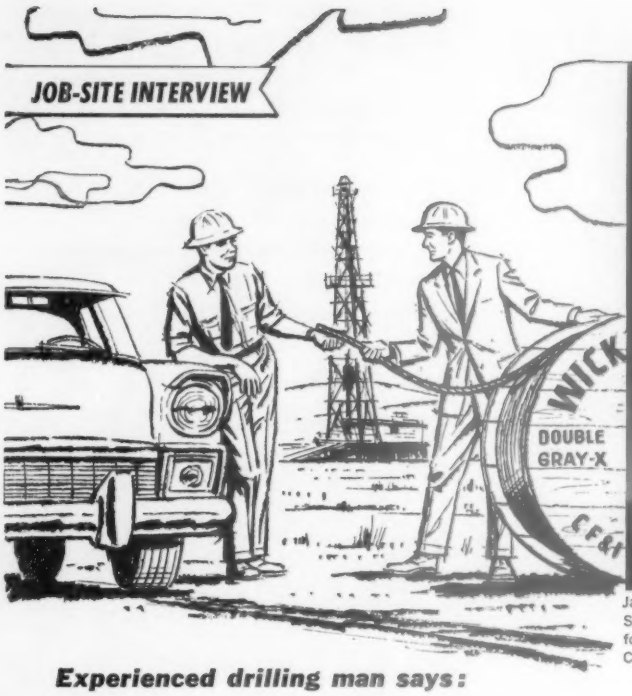

Jack Starr, Vice President in Charge of Drilling, Falcon Seaboard Drilling Company, Tulsa, Oklahoma, made the following statement in an interview with Jack Driggs, CF&I Sales Engineer.

***Experienced drilling man says:***

# "DOUBLE GRAY-X® Wire Rope gives extra-long service...that's why we ordered a carload."

"Mr. Starr, your company was one of the first to field test a prototype of CF&I-Wickwire's Double Gray-X. What led to your decision to try this new wire rope?" asked Jack Driggs.

"Falcon Seaboard insists on the best possible products to serve the oil industry in accordance with today's modern standards. As you know, rotary drilling inflicts severe punishment — abrasion, crushing and constant bending — on wire ropes. We had to have an improved wire rope to resist these destructive forces. That's why we were anxious to test CF&I's new rope," replied Mr. Starr.

"How about downtime . . . did your tests show that your equipment can be run for longer stretches with Double Gray-X than with the previous ropes that you used?" inquired Driggs.

"Definitely! That's why we ordered a carload. What's more, we're convinced that Double Gray-X provides extra-high breaking strength. This extra safety factor is extremely important in our drilling operations. Now let me ask you a question."

"Fire away," said Driggs.

"Why does Double Gray-X last longer than other wire ropes?"

"It's because of a new wire drawing process, Mr. Starr. This process, which includes the use of a special lubricant — molybdenum disulphide — builds a permanent molecular shield around each wire in Double Gray-X. This molecular jacket permits friction-free interaction of the individual wires . . . assures a smoother surface to the wires . . . and provides extra toughness . . . all factors leading to longer rope life."

"Thanks, Jack, for the information. And thanks to CF&I for the fine service you people give us," commented Mr. Starr.

Made in a wide variety of sizes and constructions, Double Gray-X is recommended for many drilling applications. Find out for yourself how this new wire rope can give you increased operating economy; call the nearest CF&I office or your Wickwire Rope distributor.

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*In the East:* **WICKWIRE SPENCER STEEL DIVISION** — Boston • Buffalo • Chattanooga • Chicago • Detroit Emlenton (Pa.) • New Orleans • New York • Philadelphia

CF&I STEEL

7931

## ACTIVE FIELDS

Estimated recovery in bbl. per acre-ft. (solution gas drive): 78.

**UNIVERSITY-WADDELL,** Crane County.
Pay: Devonian. Total depth 9,400 ft.
Costs: Flowing well $190,000. On pump $202,000. Dry hole $175,000. Footage price $6.75. Day-work rate with pipe $1,000, and without pipe $900.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 50. Total bits 35.
Casing: 13⅜-in. surface casing set at 800 ft. with 800 sacks of cement. 9⅝-in. intermediate at 4,300 ft. with 2,000 sacks of cement. 7-in. oil string at 9,400 ft. with 850 sacks of cement.
Mud: Gel, 50 sacks; caustic, 500 lb.; quebracho, 500 lb.; lease oil, 500 bbl.; fresh water.
Tops: Rustler anhydrite at 1,050 ft.; Grayburg at 3,025 ft.; Pennsylvanian at 7,600 ft.; Devonian at 8,600 ft.

**WASSON,** Gaines County.
Pay: Upper and Lower [illegible] (Permian). Total depth 7,600 ft.
Costs: Flowing well $125,000. On pump $160,000. Dry hole $65,000. Footage price $4.10. Day-work rate with pipe $750, and without pipe $675.
Rig time: 90% on footage rate; 10% on day-work rate. Total days 22. Total bits 30.
Casing: 13⅜-in. surface casing set at 380 ft. with 450 sacks of cement. 9⅝-in. intermediate at 3,300 ft. with 1,400 sacks of cement. 7-in. oil string at 7,200 ft. with 700 sacks of cement. Two strings of tubing.
Mud: Oil-water emulsion; gel, 84 sacks; emulsifier, 87 sacks; starch, 55 sacks; minor amounts of other materials including 250 bbl. oil.

## Utah

**ANETH AREA,** San Juan County.
Pay: Hermosa. Total depth 5,700 ft.
Costs: Flowing $120,000. On pump $135,000. Dry hole $95,000. Footage price $9. Day-work rate with pipe $900, and without pipe $825.
Rig time: 92% on footage rate. 8% on day-work rate. Total days 28. Total bits 35.
Casing: 10¾-in. surface casing set at 1,200 ft. with 700 sacks of cement. 7-in. oil string at 5,700 ft. with 900 sacks of cement.
Mud: Barites, 5,000 lb.; bentonites, 10,000 lb.; preservatives, 1,500 lb.; salt-water gel, 5,000 lb.; starch, 10,000 lb.
Tops: De Chelly at 2,600 ft.; Organ Rock at 2,700 ft.; Hermosa at 4,520 ft.; Ismay at 5,320 ft.; Paradox shale at 5,455 ft.; Aneth at 5,465 ft.; Chimney Rock at 5,660 ft.; Salt at 5,680 ft.

**RED WASH,** Uintah County.
Pay: Lower Green River. Total depth 5,800 ft.
Costs: On pump $125.000. Dry hole $85,000. Footage price $5. Day-work rate with pipe $825, and without pipe $800.
Rig time: 95% on footage rate. 5% on day-work rate. Total days 22. Total bits 35.
Casing: 10¾-in. surface casing set at 225 ft. with 180 sacks of cement. 7-in. or 5½-in. oil string at 5,700 ft. with 400 sacks of cement.
Mud: Bentonite, 150 sacks; caustic soda, 600 lb.; lignite, 2,000 lb.; cost is about $4,500.
Tops: Unita, surface; Green River, 3,000 ft. Wasatch 5,850 ft.


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For cementing or recementing, plug-backs or squeezes, at varying depths, pressures, drilling conditions, UNAFLO oil-well cement provides the workable slurry — one that pumps easily, sets hard.

For lesser depths, results are good whether UNAFLO is used neat or plus additives to lighten slurry weight when high fillups are desired.

At any depth, its slurries sustain high initial fluidity, and its retarded set allows proper placement with an added margin of safety for delays or emergencies.

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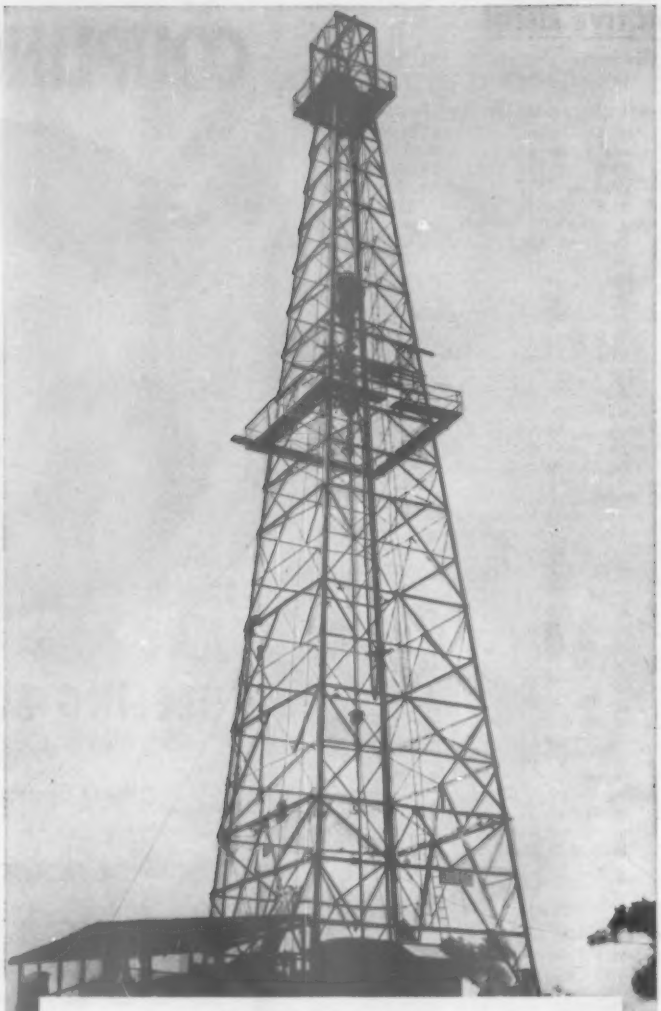

**CEMENTING DATA**

**Job** — Clemile Savoy #1, Vermillion Parish, Louisiana

**Owner** — Continental Oil Company, Houston

**Contractor:** Dillard-Waltermire, Inc., Houston

Job #1 — 11,030′ of 9⅝″ O.D. casing cemented in 12¼″ hole with 1,000 bags neat UNAFLO cement. Slurry fillup behind casing 3,130′. Drilling mud wt. 11.5 lbs/gal. Schlumberger temp. log 168° F. Est. static BHT 193° F.

Job #2 — 1,298′ of 7″ O.D. liner set in 8⅜″ hole from 10,910′ to 12,208′, cemented with neat slurry 220 bags UNAFLO. Drilling mud wt. 16.2 lbs/gal. Schlumberger temp. log 196° F. Est. static BHT 226° F.

Job #3 — Squeezed top 7″ O.D. liner with 300 bags neat UNAFLO. Final pump truck pressure 2,000 psi.

Job #4 — Squeezed 150 bags Cealment (UNAFLO plus latex) through retainer set at 12,182′ into lost-circulation zone below 7″ O.D. liner.

Jobs #5, 6, 7 — Bradenhead squeeze jobs using 100 bags; 150 bags; 150 bags Cealment respectively into lost circulation zone at 12,350′. Final pressure 400 psi.

Job #8 — 2,725′ 4½″ O.D. liner set in 6″ hole from 12,017′ to 14,742′ cemented with 300 bags UNAFLO weighted (18 lbs/gal.) with HiDense #2 (ilmenite Ore). Mud wt. 18.4 lbs/gal. Est. static BHT 284° F.

Job #9 — Full string of 7″ O.D. casing tied into top of 7″ O.D. liner at 10,910′, cemented with 50 bags neat UNAFLO.

**Universal Atlas Cement**
**Division of**
**United States Steel**

## ACTIVE FIELDS

Core data: Green River; 4,400-5,800 ft. interval; 125 md. perm.; 16% porosity; 25% resid. oil sat.; 35% total water sat.

### Wyoming

**BIG PINEY,** Sublette County.
Pay: Mesaverde. Total depth 3,300 ft.
Costs: Flowing well $45,000. On pump $55,000. Dry hole $25,000. Footage price $3.75. Day-work rate with pipe $750, and without pipe $700.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 10. Total bits 9.
Casing: 8⅝-in. surface casing set at 250 ft. with 150 sacks of cement. 5½-in. oil string at 3,250 ft. with 400 sacks of cement.
Mud: Gel, 150 sacks; caustic, 100 lb.; thinner, 400 lb.; oil 8%.
Tops: Mesaverde at 3,150 ft.; Olney at 1,750 ft.
Core data: Mesaverde: 85 ft. interval; 10 md. perm., 18% porosity; 20% resid. oil sat.; 51% total water sat.

**HAMILTON DOME,** Hot Springs County.
Pay: Tensleep. Total depth 3,200 ft.
Costs: On pump $58,200. Footage price $6.50. Day-work rate with pipe $700, and without pipe $650.
Rig time: 89% on footage rate. 11% on day-work rate. Total days 19. Total bits 20.
Casing: 10¾-in. surface casing set at 100 ft. with 100 sacks of cement. 7-in. oil string at 3,200 ft. with 250 sacks of cement.
Mud: Gel, 23,500 lb.; starch, 5,000 lb.; caustic, 700 lb.; lime, 2,300 lb.; viscosifier, 550 lb.; diesel oil, 3,000 gal.
Tops: Chugwater at 1,600 ft.; Embar at 2,800 ft.; Tensleep at 3,000 ft.
Remarks: Contract includes 24-hour lost-circulation clause, 5° vertical-deviation limit as some areas present crooked-hole problems.

**LA BARGE,** Sublette County.
Pay: First and Second Frontier. Total depth 7,000 ft.
Costs: Flowing well $140,000. Dry hole $80,000. Footage price $6.25. Day-work rate with drill pipe $850, and without pipe $800.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 40.
Casing: 10¾-in. surface casing set at 1,250 ft. 7-in. oil string set at 7,000 ft.
Mud: Gel, 10 to 12 lb. per gal.
Tops: Almy at surface; Hilliard at 1,200 ft.; Frontier at 6,000 ft.; First Frontier at 6,100 ft.; Second Frontier at 6,500 ft.

**MILLER CREEK,** Crook County.
Pay: Dakota. Total depth 6,000 ft.
Costs: Flowing well $56,000. On pump $62,000. Dry hole $27,000. Footage price $3.15. Day-work rate with pipe $875, and without pipe $825.
Rig time: 85% on footage rate. 15% on day-work rate. Total days 12. Total bits 8.
Casing: 8⅝-in. surface casing set at 200 ft. 5½-in. oil string.
Tops: Dakota at 5,900 ft., 0-50-ft. thick.
Core data: Dakota, 11 ft. interval; 14.2% porosity; 50% total water sat. Dakota, 27 ft. interval; 19.1% porosity; 41.3% total water sat. Estimated recovery, bbl. per acre-ft. (gas expansion): Dakota 11 ft. interval, 103; Dakota 27 ft. interval, 140.


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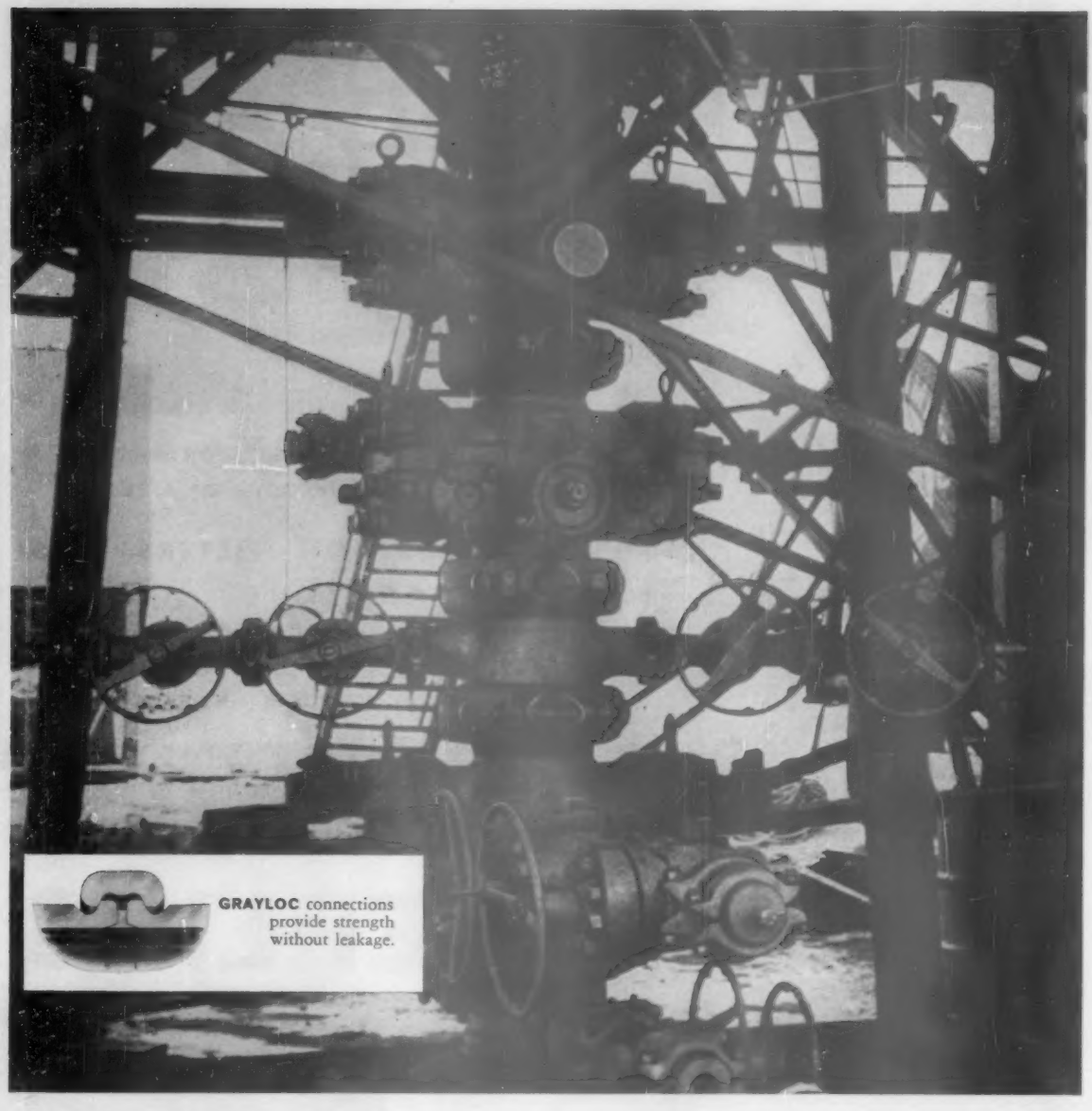


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## ACTIVE FIELDS

**PATRICK DRAW,** Sweetwater County.
Pay: Almond. Total depth 5,100 ft.
Costs: Flowing well $55,000. Dry hole $25,000. Footage price $3.25. Day-work rate with pipe $750, and without pipe $700.
Rig time: 85% on footage rate. 15% on day-work rate. Total days 13. Total bits 7.
Casing: 8⅝-in. surface casing set at 300 ft. with 180 sacks of cement. 5½-in. oil string at 5,000 ft. with 80 sacks of cement.
Mud: Bentonites, 500 lb.; preservatives, 100 lb.
Tops: Lewis at 3,500 ft.; Almond at 4,900 ft.; Erickson at 5,200 ft.
Core data: Almond, 25 ft. interval; 12 md. perm.; 18.5% porosity; 18% resid. oil sat.; 37.5% total water sat.

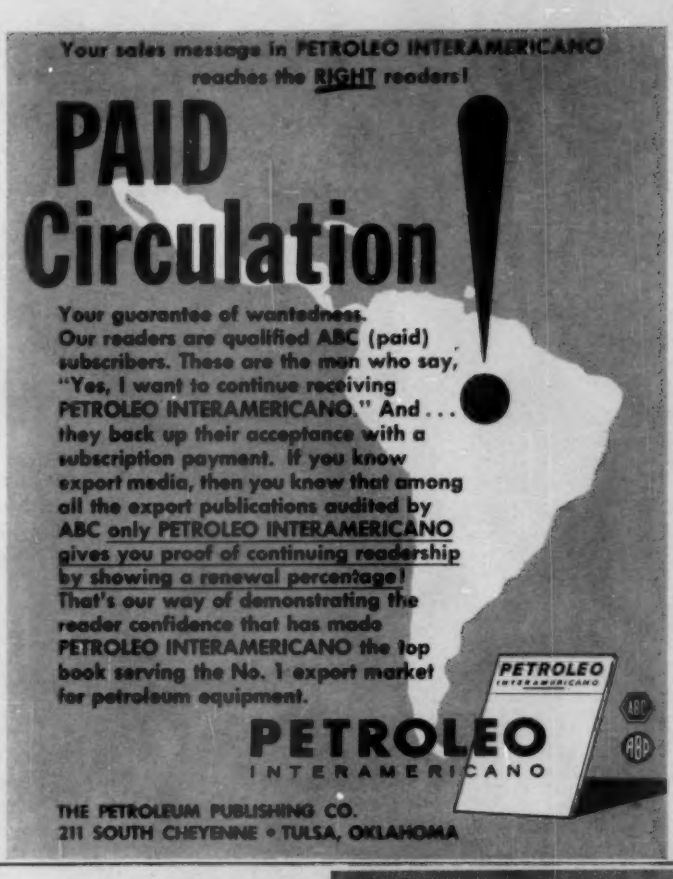
**ROZET,** Campbell County.
Pay: Muddy sandstone. Total depth 7,000 ft.
Costs: On pump $82,500. Footage price $2.88. Day-work rate with pipe $850, and without pipe $750.
Rig time: 95% on footage rate. 5% on day-work rate. Total days 11. Total bits 12.
Casing: 10¾-in. surface casing set at 200 ft. with 150 sacks of cement. 5½-in. oil string at 7,000 ft. with 250 sacks of cement.
Mud: Native mud to top of Muddy sand. Low water loss, 20% oil-emulsion mud through pay zone.
Tops: Muddy at 6,925 ft.
Core data: Muddy: 24 ft. interval; 26.5 md. perm.; 18.2% porosity; 12.7% resid. oil sat.; 56.1% total water sat.
Estimated recovery, bbl. per acre-ft. (gas expansion): 95.

**WEST DESERT SPRINGS,** Sweetwater County.
Pay: Lewis and Almond. Total depth 6,000 ft.
Costs: Flowing well $110,000. Dry hole $60,000. Footage price $7. Day-work rate with drill pipe $900, and without pipe $775.
Rig time: 95% on footage rate. 5% on day-work rate. Total days 25. Total bits 20.
Casing: 10¾-in. surface casing set at 450 ft. with 200 sacks of cement. 5½-in. oil string set at 6,000 ft. with 500 sacks of cement.
Mud: Gel, fresh-water 10-lb. weight.
Tops: Lewis at 5,000 ft.; Almond at 5,400 ft.; Erickson at 6,000 ft.

### Canada

**CROSSFIELD,** Alberta
Pay: Cardium. Total depth 6,750 ft.
Costs: Flowing well $65,000. Footage price $4.00. Day-work rate with pipe $780.
Rig time: 96% on footage rate. 4% on day-work rate.
Casing: 8⅝-in. surface casing set at 660 ft. with 350 sacks of cement. 2⅞-in. oil string at 6,754 ft. with 700 sacks of cement.
Tops: Basal Belly River at 5,231 ft.; Colorado at 5.731 ft.; Cardium at 6,548 ft.; Lower Cardium at 6,733 ft.
Core data: Lower Cardium: 40 ft. interval; 19.0 md. perm.; 16.5% porosity; 36.5% resid. oil sat.; 22.1% total water sat.
Estimated recovery, bbl. per acre-ft. (gas expansion): 150.

**SIMONETTE RIVER,** Alberta.
Pay: Mississippian-Leduc. Total depth 11,500 ft.
Rig time: 84% on footage rate. 16% on day-work rate. Total days 78. Total bits 72.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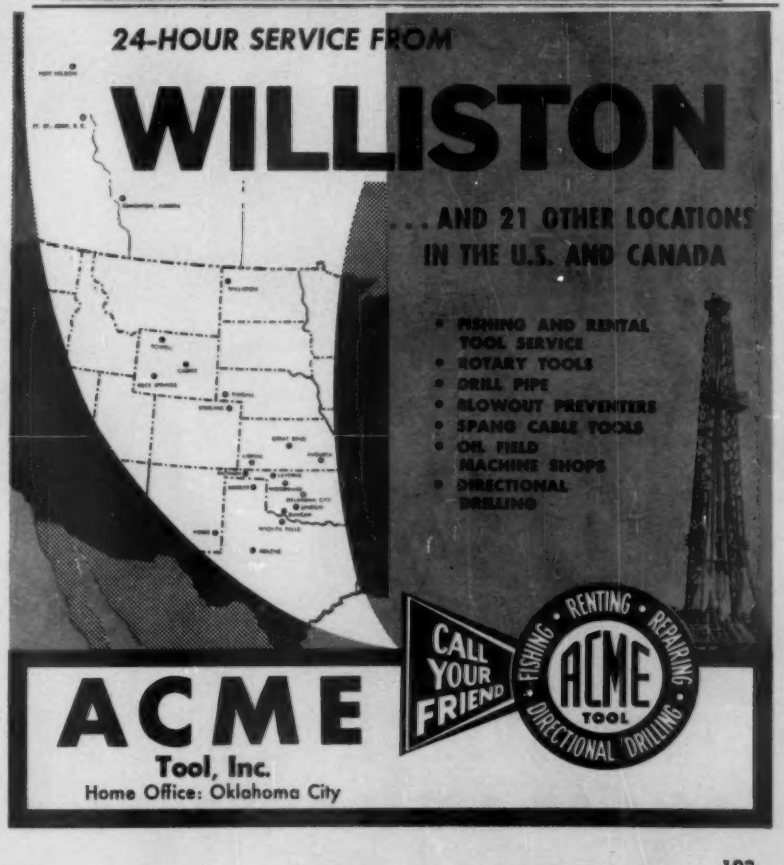

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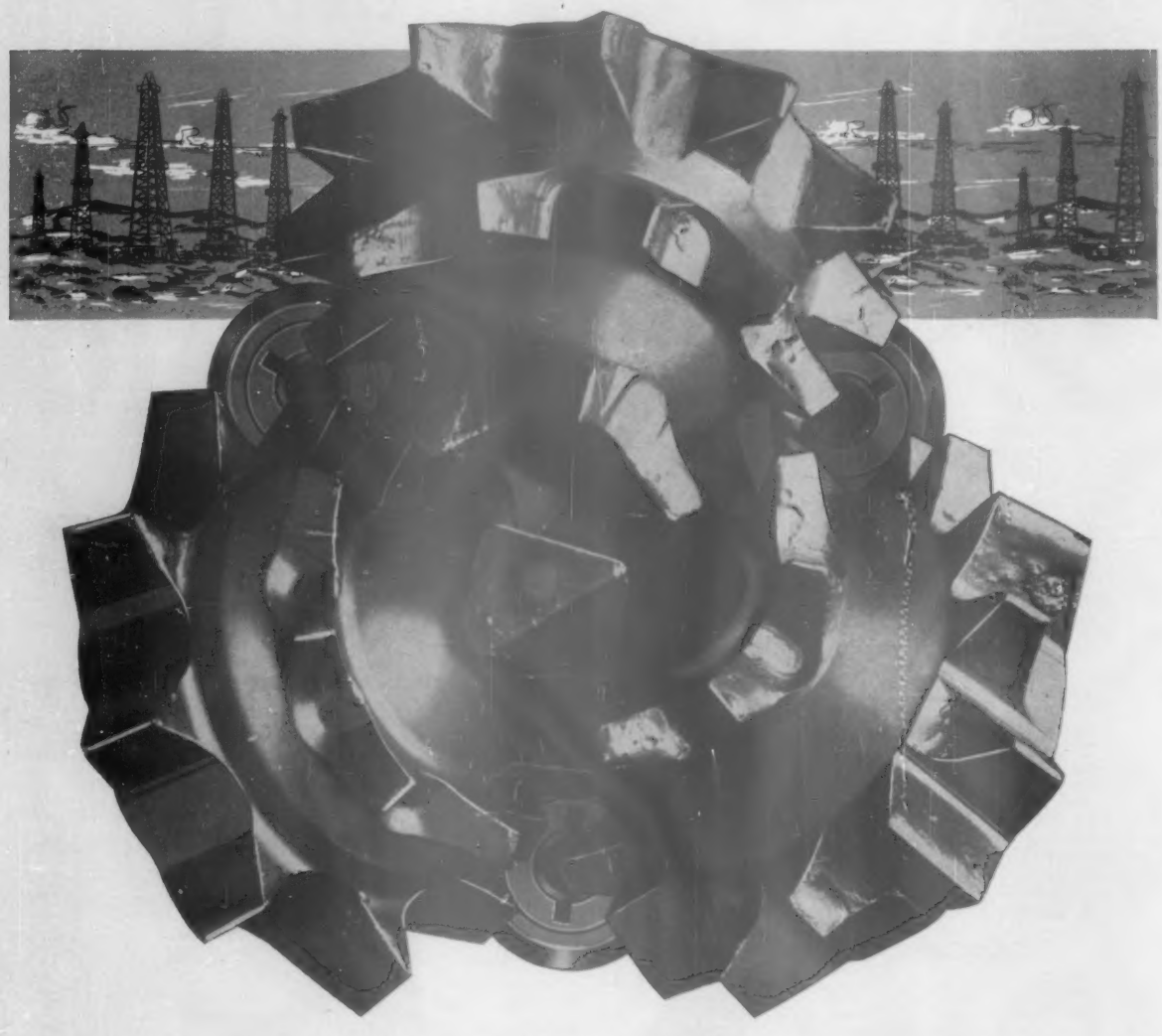

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## ACTIVE FIELDS

Casing: 10¾-in. surface casing set at 1,500 ft. with 850 sacks of cement. 5½-in. oil string at 11,500 ft. with 1,600 sacks of cement.
Mud: Gel, 730 sacks; caustic, 2,800 lb.; barium, 5,000 lb.; quebracho, 3,700 ft.; barium carbonate, 2,200 lb.
Tops: Cardium at 4,900 ft.; Viking at 6,510 ft.; Wabamun at 10,200 ft.; Leduc 11,500 ft.

**SWAN HILLS,** Alberta.
Pay: Beaverhill Lake (Mid-Devonian). Total depth 8,400 ft.
Costs: Flowing well $175,000. Dry hole $125,000. Footage price $5.50. Day-work rate with pipe $1,050, and without pipe $1,000.
Rig time: 85% on footage rate. 15% on day-work rate. Total days 38. Total bits 30.
Casing: 10¾-in. surface casing set at 600 ft. with 600 sacks of cement. 5½-in. oil string seated at 8,400 ft. with 400 sacks of cement. (Around show; used staging collars and cemented 200 ft. above second Specks.)
Mud: Water-gel emulsion mud below 5% by volume with oil, or diesel-base mud. Serious shale sluff; experimented with shale-resistant mud.
Tops: Second Specks at 3,200 ft.; Blairmore at 4,016 ft.; Wabamun at 5,600 ft.; Beaverhill Lake at 7,900 ft.; Swan Hills member of Beaverhill Lake at 8,050 ft. Note: These wells have 10-155 ft. of net pay in reef.

**WATESTON PARK,** Alberta.
Pay: Mississippian - Livingstone. Total depth 11,000 ft.
Rig time: 90% on footage rate. 10% on day-work rate. Total days 180. Total bits 160.
Casing: 13⅜-in. surface casing set at 1,100 ft. with 1,100 sacks of cement. 7-in. oil string at 10,400 ft. with 1,400 sacks of cement.
Mud: Low-solids lime mud. Material used varies with lost-circulation problems.
Tops: Cardium at 4,400 ft.; Mississippian at 10,000 ft.; Mississippian-Livingstone at 10,350 ft.

**FORT NELSON,** British Columbia.
Pay: Mississippian at 2,000 ft.; Slave Point (Middle Devonian) at 6,600 ft. Total depth 7,000 ft.
Costs: Flowing well $230,000. Dry hole $150,000. Footage price $8.25. Day-work rate with pipe $1,200, and without pipe $1,150.
Rig time: 67% on footage rate. 33% on day-work rate. Total days 45. Total bits 35.
Casing: 13⅜-in. surface casing set at 620 ft. with 450 sacks of cement. 7-in. oil string at 6,550 ft. with 1,040 sacks of cement.
Mud: Gel, 56,500 lb.; caustic, 1,625 lb.; lime, 50 lb.; redwood bark, 3 sacks; sawdust, 120 sacks; quebracho, 1,250 lb.; thinners, 1,070 lb.; CMC, 250 lb.
Tops: Mississippian at 2,000 ft.; Slave Point at 6,600 ft.

**OFFSHORE LAKE ERIE,** Ontario.
Pay: Guelph. Total depth 1,400 ft.
Costs: Flowing well $35,000. Dry hole $32,000. Footage price $20-25. Day-work rate without pipe $625.
Rig time: 80% on footage rate. 20% on day-work rate. Total days 30.
Casing: 10¾-in. surface casing set at 200 ft. with drive pipe. 8⅝-in. intermediate at 300 ft. with casing shoe. 7-in. oil string at 1,200 ft. with 180 sacks of cement. Remarks: Mostly cable-tool drilling.
Tops: Dundee at 200 ft.; Bass Island at 600 ft.; Guelph at 1,200 ft.


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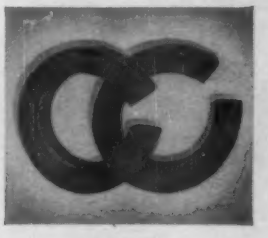
No other drive puts as much extra push in deep hole drilling as the exclusive, patented R/M Poly-V! Delivers much more power than a V-drive of equal width...or equal power in much less width. Single unit belt design eliminates belt matching problems in the field . . . reduces field inventories. Just *two* belt cross sections meet every heavy duty drive requirement. Maintains groove shape, complete contact pressure. Write for Poly-V Drive Bulletin M141.

**Convert to Poly-V and be SURE!**



### *R/M "TEFLON"* PACKINGS*

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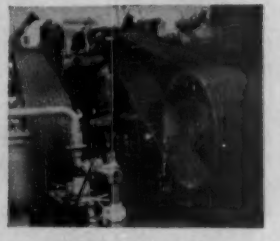
When you use R/M "Teflon" braided and asbestos packings you can forget the kind of troubles that you normally experience from strong acids and corrosive liquids. "Teflon" is completely chemical resistant except to fluorine and chlorine trifluoride at high temperatures and molten alkali metals. No known solvent will act on it—no acids or caustics will attack it. It is nonadhesive and thus excellent for applications involving viscous materials. Write for information.

*A Du Pont Trademark

### *RAY-MAN ROTARY HOSE*

**Strong • Safe • Flexible**

Special high-tensile steel cable wire reinforcement, precision wound under tension, gives Ray-Man CBL Rotary Hose unequalled strength and flexibility for safer, easier handling and make-up on the rig. Resists kinking and accidental crushing in transport . . . holds steadier in the derrick *without whipping*—even under high pressures of deep drilling. Streamlined, built-in coupling has no protruding lugs or flanges—features R/M leak-proof "Lip-Lok" seal that tightens under pressure to prevent blowouts! Write for Oilfield Hose Bulletin M651.



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**Length Stabilized**

No whip, no wobble, no weave—no undue stress or V-belt turnover on long center, heavy duty oilfield drives! Condor LS V-belts are *length stabilized* to give a degree of lateral and longitudinal stability *without stretch* never before possible. They're length *certified*, too . . . measured, tagged and vacuum packaged to assure positive length control and freshness from factory to field to drive. Condor LS V-belts come matched—stay matched to outperform, outlast any other V-belt under the heaviest loads. Write for Bulletin M210.

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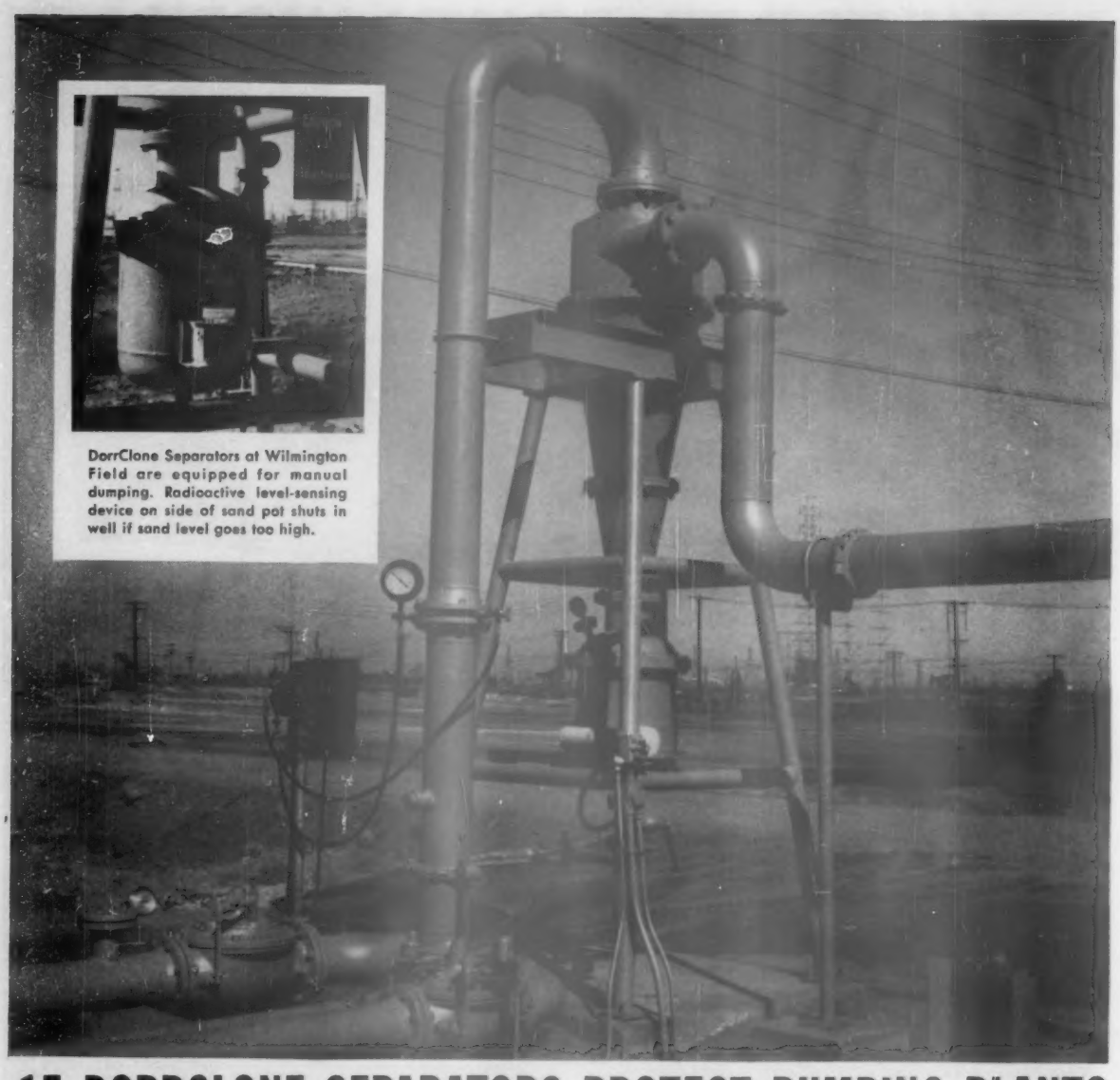


DorrClone Separators at Wilmington Field are equipped for manual dumping. Radioactive level-sensing device on side of sand pot shuts in well if sand level goes too high.

# 15 DORRCLONE SEPARATORS PROTECT PUMPING PLANTS FROM SAND IN WORLD'S LARGEST FLOODING OPERATION

■ California's Wilmington Field water flood operation, built and owned by the Long Beach Harbor Department, is being systematically carried out, fault block by fault block. Purpose is to increase oil recoveries, and to check land subsidence in the field.

At the heart of the system are completely automatic plants which take oxygen-free brine from nearby source wells, desand it, treat it and pump it into the oil bearing zones at 850-1250 psig.

DorrClone separators are operating on 15 wells in the field – removing 98% of all material with a specific gravity greater than 2.6. They keep mains and pumps sand-free for continuous operation at full capacity.

Feed water enters the upper chamber of the DorrClone unit tangentially creating a vortex action. Resulting centrifugal force throws the sand particles to the rubber coated walls of the cone where they pass downward to the underflow chamber. Sand-free water moves to the inner spiral of the vortex and is displaced upward and out into the mains.

The photograph demonstrates the simplicity of the installation. Units can be designed to suit practically all well water systems. For full information, write, Dorr-Oliver Incorporated, Stamford, Conn.

DorrClone – T.M. Reg. U.S. Pat. Off.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

# Why sucker rods fail (continued)

BY JOSEPH ZABA

SHARP DIFFERENCES of opinion exist regarding the proper amount of makeup torque which should be applied to sucker-rod joints. First, they differ regarding the amount of the preload needed over and above the theoretical minimum. Second, the relationship between the preload and the torque needed to get the desired preload is quite complex. Among the factors which affect this relationship is the friction between mating surfaces of the joint. A large portion of the applied torque is used in overcoming this friction and only a small part is available to preload the joint.

In No. 15 of this series an equation was presented for the theoretical minimum applied preload.[1] Since the maximum permissible loading of rods of different sizes and types is known, the theoretical minimum preload can be calculated. However, because of many unknowns which are involved, a safety factor is needed.

Among the unknowns is the possibility of relaxation of th properly applied preload. This relaxation may be caused by the tendency of the joint to unscrew, even if tightened by a proper torque. The unscrewing of the joint may be brought about by (1) presence of grease on the shoulder faces of the pin and coupling, which would reduce friction resisting loosening of the joint, (2) lack of parallelism of the contact faces, or (3) the tendency of the joint to unscrew under certain types of loading.

As pointed out by Ritterbusch, a properly preloaded sucker-rod joint is a nonreversible mechanism. The coefficient of friction exceeds the effect of the helix angle of the pin thread, and a straight pull on the pin will not unscrew the coupling. However, under certain types of loadings the coupling and the pin expand and contract, causing the relative radial motion between the faces of the pin and coupling threads. This may have an effect of reducing the coefficient of friction below the helix effect with the resulting unscrewing of the joint. Loadings which may bring about this type of condition are those resulting from operation under wide range of loads, of those resulting from repeated shock loads, such as those caused by fluid pound.

**Suggested torque values.** Because of all the unknowns affecting the problem, Ritterbusch suggested that the preload should equal the allowable working load of the rod used. This would give the safety factor of approximately 2 to 1 relation to the theoretical minimum preload. Using this assumption, and determining, by use of existing formulas and experimental data, the torque needed to effect the preload, he suggested preloads and makeup torques for different sizes of two types of rods, Table 3.

As an example illustrating the wide variation of opinion regarding makeup torque, the recommendations of different manufacturers for ⅞-in. rods of different types range from 290 to 700 ft.-lb.

A special task group has been formed within the API Division of Production Sub-Committee on Sucker Rods, to study this subject. After 1 year's work the task group presented in June 1960 its recommendations shown in Table 4. These are not yet an official expression of the API Division of Production since they have to be approved by the members of the appropriate API committee. If approved they will be incorporated into the forthcoming revision of API RP.11BR "Recommended Practice for Care and Handling of Sucker Rods."

**Field application.** Assuming the correctness of the values for needed makeup torque, which were arrived at by theoretical considerations and experiments, the remaining problem is application of this torque in field practice. The prerequisite of success of this operation is a free-running fit of the joint to the shoulder contact. The joint must be completely clean with shoulder faces free of grease. It must be undamaged with threads well greased. In running a new rod string for the first time, making up each joint to the proper tightness, then breaking it and making it up again, contributes toward better seating of the joint due to smoothing out of the contact surfaces as a result of plastic flow in the metal.

With the hand-wrenching method of making up the rod joints it is difficult to maintain proper magnitude and uniformity of makeup torque even with an experienced and well trained rod crew. This is particularly true in the case of long, tapered rod strings, when increased effort is required of the man handling the wrench toward the end of the run when larger size rods have to be made up. This effort is quite considerable. For instance, even assuming a 3-ft. arm of leverage, a force of around 270 lb. is required in snapping up a joint of 1-in. rod in order to arrive at the torque recommended in Table 4 for rod of this size.

Because of this there is a trend toward increased use of pneumatic or hydraulic sucker-rod tongs. This is true not only in cases where unscrewing of rod joints is a particularly severe problem, but also in routine operations. The air or hydraulic operated rod tongs provide the desired torque uniformly throughout the whole rod string. Cases are known in which the frequent rod joint failures have been eliminated by the use of this method. However, certain special precautions must be taken to insure satisfactory results.

Care must be exercised in handling the joint to prevent crossthreading and galling of the threads. This risk should be minimized by the adaption in the new API Standard for Sucker Rods of the Class 2A-2B thread which provides for larger tolerances than those of the previous API joint thread. Mechanical conditions of the tongs must be frequently checked because of possible increase of friction within the tong as a result of wear. Particular attention must be paid to the gages since completely erroneous results may be brought about by their malfunction.

While the improper makeup of rod joints is not the only cause of their failure, the economic importance of the proper field makeup practices can not be emphasized too strongly.

**TABLE 3—TORQUE VS. SUGGESTED OPTIMUM PRELOAD**

| Rod size, in. | 44,000-psi. rod Preload reg. | 44,000-psi. rod Average torque ft.-lb. | 33,000-psi. rod Preload reg. | 33,000-psi. rod Average torque ft.-lb. |
|---|---|---|---|---|
| ⅝ | 13,600 | 140 | 10,170 | 125 |
| ¾ | 19,400 | 310 | 14,620 | 235 |
| ⅞ | 26,400 | 435 | 19,900 | 300 |
| 1 | 34,300 | 730 | 26,000 | 550 |

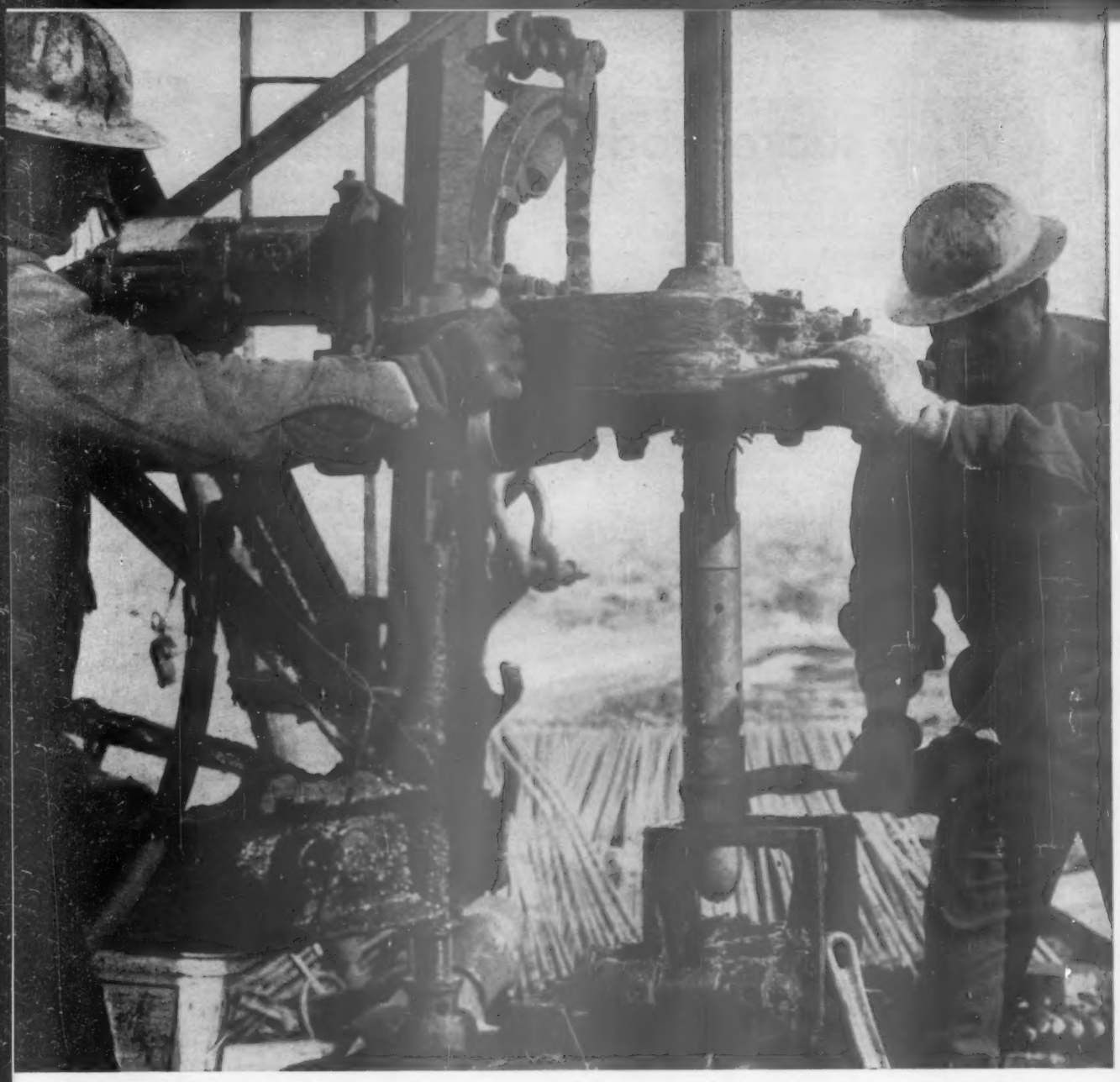
**TABLE 4—SUGGESTED MAKEUP TORQUE, IN FOOT POUNDS, FOR DIFFERENT SIZES OF SUCKER RODS**

| Rod stress | ½ in. | ⅝ in. | ¾ in. | ⅞ in. | 1 in. | 1⅛ in. |
|---|---|---|---|---|---|---|
| 35,000 psi. | 110 | 220 | 350 | 520 | 800 | 1,100 |

For stresses over 35,000 psi. add 10% to above values.

**Reference**

1. W. H. Ritterbusch, Jr., "What Torque On Sucker-Rod Joint?"; The Oil and Gas Journal, May 4, 1959.



*ABRASIJET--A NEW KIND OF SERVICE THAT HELPS YOU*

# MAKE POOR WELLS GOOD AND GOOD WELLS BETTER

Abrasijet* is a new Dowell-developed formation cleaning and perforating service. It uses high-velocity streams of fluid and abrasive particles, usually sand (pumped through small jet orifices in the tool pictured above) to perforate casing or cut through well bore damage. Water, oil, acid and mud have been used as the sand-carrying fluid.

Reports from field after field show that Abrasijet gives better results than more conventional treatments in many instances. These same reports also show that Abrasijet has been successful in cases where all other treatments failed. Here are a few examples:

**IN SOUTH TEXAS.** Abrasijet was used to re-perforate a Wilcox well and penetrate beyond gyp deposited near the well bore. Production had dropped to 10 bopd on gas lift. Five sets of two perforations per level were jetted using Dowell inhibited acid and sand. *Production rose to 96 bopd with 880 psi flowing pressure.*

**IN NORTHWESTERN NEW MEXICO.** *Abrasijet was used to complete a 260 bopd flowing well in an area surrounded by dry holes.* Completion was into a 22-foot section of the Dakota. Abrasijet was employed to make 48 perforations in twelve settings of a four-jet tool. Well was also fractured in the basic eight-hour pump-rental time.

# NEW IDEAS FROM DOWELL

*TO HELP YOU MAKE MORE PROFIT*

### "ACID GUIDE"*

This new companion to the "Frac Guide"* is used by Dowell for *better* engineering of acid treatments. Results have been greater production increases, lower treatment costs, or both. Probable results of acid treatments can be predicted, and the most promising treatment selected for a given well.

### CORROSION INHIBITOR SQUEEZE

This Dowell-developed technique for inhibiting corrosion in oil wells has given excellent long-term protection with minimum cost of application. Second and later applications of Corban* inhibitor by "squeezing" it into the producing formation have been even more efficient than the first.

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This new Dowell addition agent can be added to water used in fracturing to induce foaming and reduce swabbing time. It is also used to facilitate air or gas drilling through low-production water zones. For air drilling, it minimizes "balling" of cuttings and creates a foam for easier water removal.

**IN SASKATCHEWAN, CANADA.** *A well was successfully perforated with Abrasijet after two attempts at explosive perforating had failed.* 4½-inch casing had been cemented through the Mississippian pay from 2318 to 2323 feet. Four perforations were made followed by a frac job. *One month later production was averaging 70 to 80 bopd in a field where most wells average only 50 to 60 bopd.*

**IN CENTRAL KANSAS.** *A well that produced only water on initial completion was recompleted successfully with Abrasijet.* A radioactive survey showed a channel from initial perforations at about 3318 feet to bottom of casing at 3405 feet. Well was squeezed with cement to shut off water. Abrasijet was used to reperforate without shattering cement. New perforations were from 3323 to 3329 feet. *After acidizing, well tested 6.5 boph with only a trace of water.*

The chances are good that you can increase your profits with Abrasijet. For prompt service or detailed information on Abrasijet, *dial Dowell.* There are 150 offices and stations in the United States, Canada, Argentina and Venezuela. Dowell, Tulsa 1, Oklahoma.

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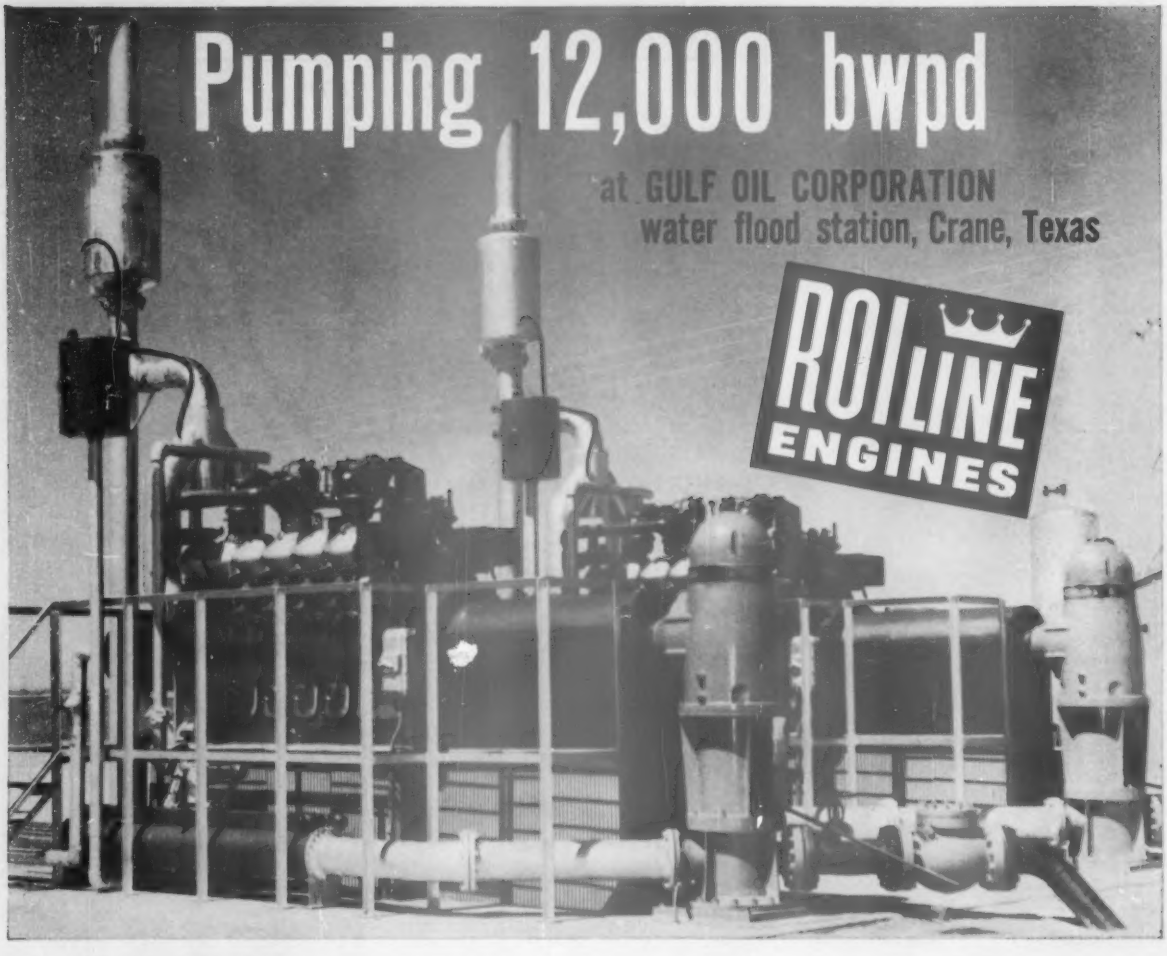
*Services for the oil industry*

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

# Pumping 12,000 bwpd

at GULF OIL CORPORATION
water flood station, Crane, Texas



• At their water flood station, near Crane, Texas, Gulf Oil Corporation, Midland, Texas, is using ROILINE engines to pump 12,000 bwpd at 600 psi. The Johnson turbine pumps are driven by two Model L-3460 ROILINE engines, each delivering 325 hp at 1000 rpm burning natural gas. These are 12-cylinder V-type engines of 3468 cu. in. displacement with a 7¼-in. bore x 7-in. stroke (see illustration at left). Their modern, basically simple design means all-around dependability combined with high fuel economy and long service life.

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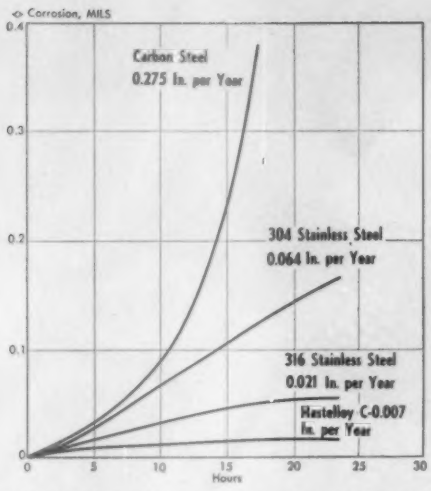
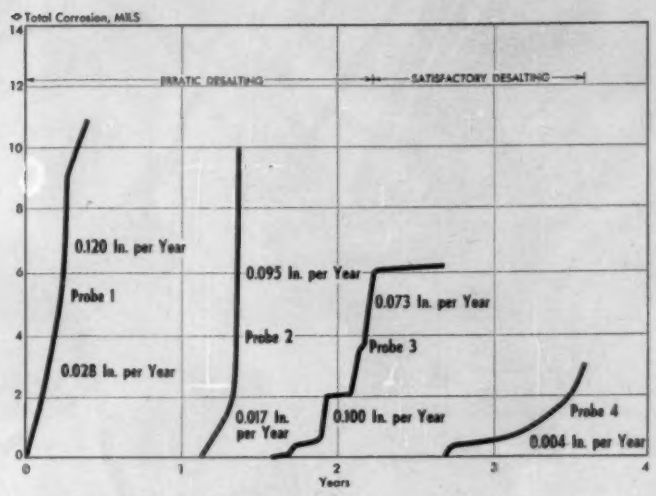



**EVALUATION** of construction material at 104° F. Fig. 1.




**CORROSION MONITORING** in new unit shows data obtained by four probes over a 4-year period. Fig. 2.

Here are some pointers on . . .

# Where to use corrosion probes

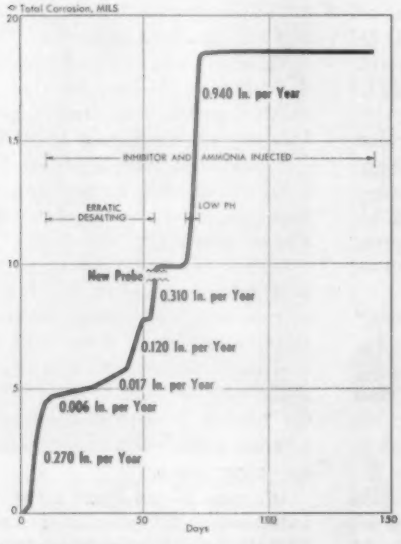
**Electrical-resistance probes are now widely used in the petroleum industry to evaluate the corrosivity of process streams, to evaluate materials of construction, and to determine the optimum concentration of inhibitors. Here are some typical applications.**

THE CORROSION PROBE is the most sensitive method in use for detecting and measuring corrosion. Since it can measure losses as small as a few millionths of an inch, the probe's accuracy allows corrosion rates to be determined rapidly. Continuous corrosion monitoring is possible because probes may be installed at any point in the unit and measurements can be made without interfering with normal operation.

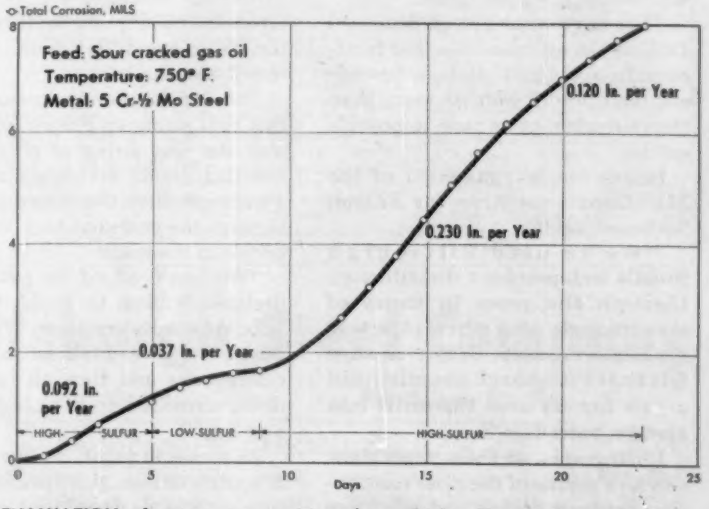
Because of the probe's high sensitivity, the effects of small changes in operating conditions can be evaluated, and corrosion-prevention methods can be devised and tested while the unit is still on stream.

E. S. Troscinski, A. S. Couper, and Andrew Dravnieks, all of Standard Oil Co. of Indiana's research and development department, reported the following applications of corrosion probes to the ASME Petroleum Division conference in New Orleans, September 19.

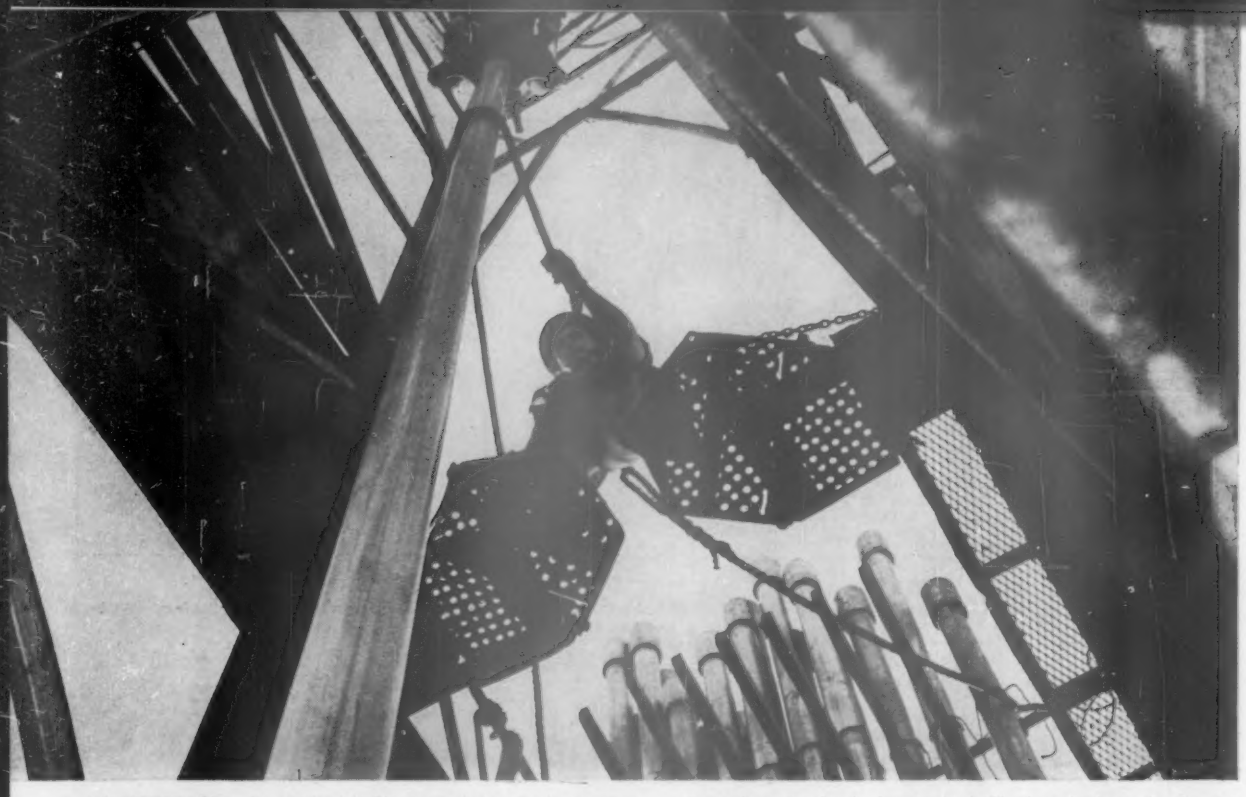
**Evaluating materials of construction.** From a few laboratory tests, the types




**EFFECT** of operating changes on corrosion. Fig. 3.




**EVALUATION** of stream composition shows high-sulfur oil boosted chances of corrosion. Fig. 4.



**LOOKING UP—Length of drill starts into the hole after change of bits. Falcon Seaboard Drilling Co. of Tulsa is drilling this well with a 9,500-foot string of Pittsburgh Seamless 4¼-inch Grade E drill pipe. Falcon Seaboard has used Pittsburgh Steel tubular goods and an independent distributor for many years with pleasing results.**

*Pittsburgh Steel's Independent Distributors . . .*

# PUT THIS IN YOUR PIPE---SERVICE!

Drillers who use Pittsburgh seamless on well after well have a lot more than dependable drill pipe, casing and tubing going for them.

They have what Falcon Seaboard Drilling Co. of Tulsa calls "fair treatment from the mill" and—independent distributors who go more than the proverbial extra mile to provide service.

Boone Smiley, manager of the Mid-Continent Area for Falcon Seaboard, said:

**"We've used Pittsburgh Steel's independent distributors through the years in times of short supply and when pipe was readily available. We've always felt that Pittsburgh Seamless did a job for us and the mill has always been fair."**

Photographs on these pages show effective results of the close relationship between drillers and operators on one side and a Pittsburgh Steel independent distributor on the other. Here, near Maysville, Okla., Falcon Seaboard is using 9,500 feet of Pittsburgh Seamless 4½ inch O.D. Grade E Drill Pipe on the fourth well the string has drilled in the area in recent months.

The independent who supplied this drill string to Falcon Seaboard sold the first string of oil country tubular goods manufactured by Pittsburgh Steel. Continued progress through the years has been based on *service* to the trade.

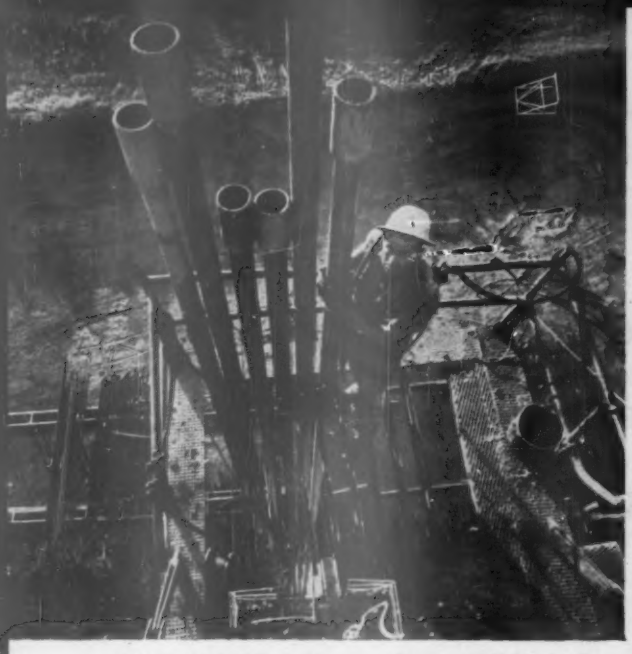
"We can't afford to get lazy," declared William G. Rudd, the distributor's sales manager. "The oil business is always subject to critical emergencies and they all have big dollar signs. It's up to us to pitch in and help."

As a case in point, during periods of acute shortage, this distributor set up a service called the Mid-Continent Pipe Exchange. As a free service to the industry, oilmen were polled for tubular material which they wished to swap for goods more strategically located, or more suited to their needs.

**This extra service by Pittsburgh distributors is matched by the extra stamina you always get in Pittsburgh Seamless Drill Pipe—a stamina which stems from long experience in making special steels for the special jobs in the oil country.**

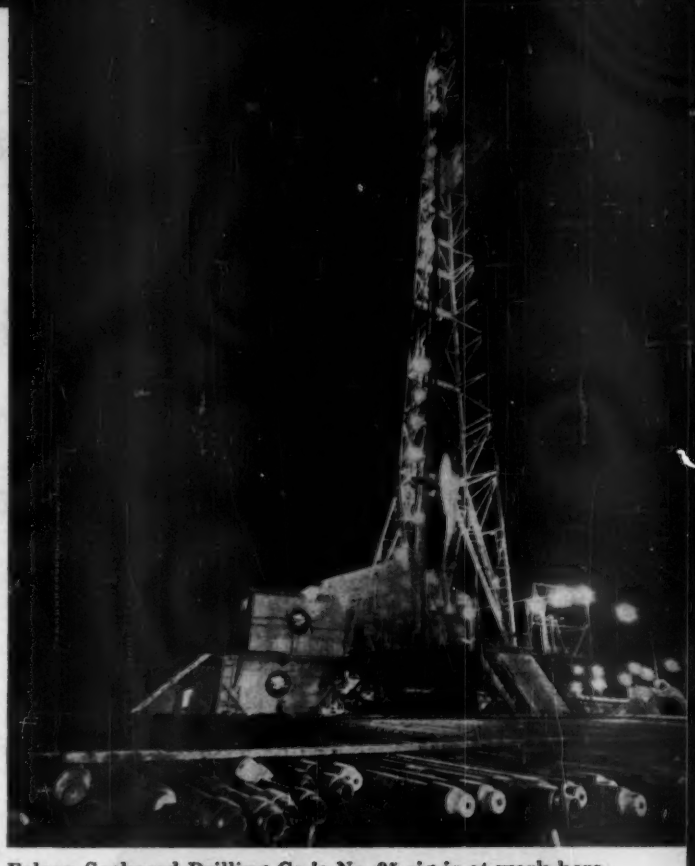
When you buy your next string of drill pipe, or when you're ready to run casing or tubing, remember the combination of Pittsburgh Steel Co. and independent distributors offers you the kind of service—plus the utmost in dependable seamless tubular goods—that isn't available any other place.

It's easy to get lined up with an independent. They're listed at right. Call the nearest one today for quality seamless tubular products.



LOOKING DOWN—On monkey board of 131-foot, A-mast rig, roughneck gets joint of Pittsburgh Steel Co. drill pipe ready for re-entry during a trip. The 9,500 feet of drill pipe shown at top and on racks below was used to drill three previous wells.

Driller Oliver Clark, left, chats with Max Thomas, distributor's representative, and Jewel Smith, Pittsburgh Steel field engineer.



Falcon Seaboard Drilling Co.'s No. 35 rig is at work here on a Sunray Mid-Continent lease near Maysville, Okla.

Geolograph on same rig shows hole is at 4,296 feet with the rotary table, seen at right, operating smoothly. Geolograph chart indicates driller is midway between joint connections.

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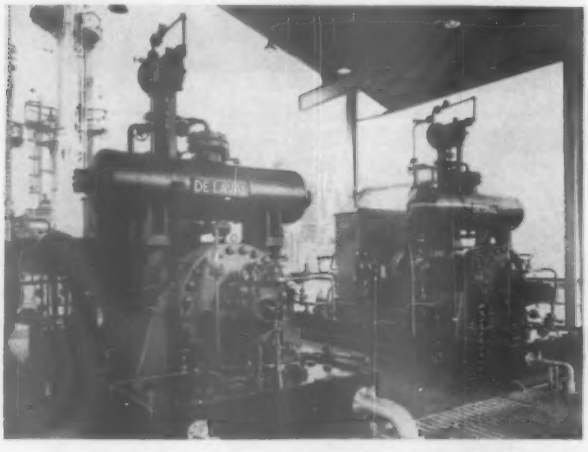


Shown above are two De Laval barrel type compressors—driven by De Laval turbines—in a typical large refinery installation. Units like these are used to pump heavy and light gases and for supplying combustion air for cat crackers.

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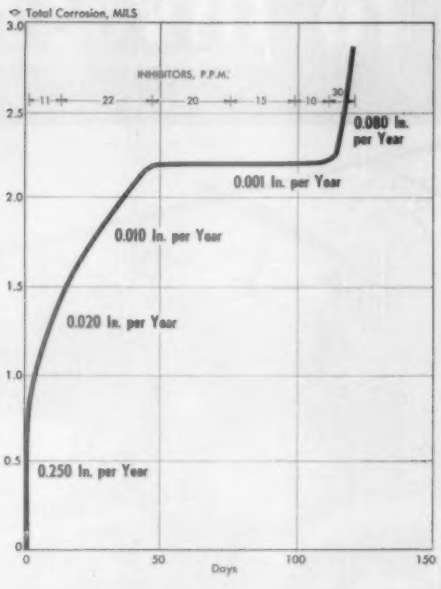



**EVALUATION** of corrosion inhibitors shows differences in effectiveness. Fig. 5.

of alloys required to build pilot-plant equipment can be determined readily. Fig. 1 shows typical corrosion information that can be gathered in laboratory screening tests. Data were obtained from a single corrosion test in an organic-acid solution containing impurities.

Carbon steel would be unsuitable for use in this service. Even Type 304 stainless steel appears inadequate.

Type 316 stainless steel looks promising and probably is a reasonable construction material. Moreover, corrosion of this alloy appears to be decreasing to a negligible value after about 20 hours. This effect could be caused either by protective-film formation or by depletion of the corrosive agent in solution. Such beneficial effects may not be realized in an actual process, especially under high-velocity conditions or in a continuous process in which depletion effects are negligible.

Hastelloy C could be relied upon for excellent corrosion protection if subsequent work proved Type 316 stainless steel to be unsuitable.

In this example, data obtained with corrosion probes indicated in a short time what class of alloys could be considered for the application and indicated relative corrosion rates. Of course, the ultimate choice of material can be made only after evaluating all of the factors that might influence corrosion.

**Evaluating corrosivity of new processes.** The effect of temperature of distillation residues on corrosion rate of Type 316 stainless steel was determined with laboratory-type corrosion probes. In a short time, probe data showed that the steel probably would be a suitable construction material at temperatures up to about 350° F. In this temperature range, the protective oxide films on the surface of the steel appeared to be maintained; at higher temperatures, the films broke down, and corrosion accelerated.

**Corrosion monitoring at critical locations.** Fig. 2 shows the data obtained by four probes monitoring corrosion for about 3 years in the overhead stream from a crude-oil-distillation unit.

When desalting was poor, corrosion rates were high despite the use of ammonia for pH control and of about 10 p.p.m. of a commercial corrosion inhibitor. When the desalter operated satisfactorily, corrosion became negligible, as shown by the horizontal portions of the curve for probe 3.

After the corrosion inhibitor was changed, probe 4 showed that corrosion rate increased parabolically. This type of curve indicates either an increase in general corrosion or it indicates pitting. In this case, the probe was removed for laboratory evaluation, and pitting was discovered.

About this time, the unit was shut down and the overhead condensers were inspected and calipered for the first time in 3 years. Measurements showed a thickness loss of 0.12 in., and some pitting was detected.

Caliper measurements gave an average corrosion rate of 0.04 in. per year, whereas the probes had shown rates ranging from negligible to 0.12 in. per year. On the basis of the probe readings, correlations between corrosion and operating conditions could be made, and the necessary steps could be taken to control corrosion.

**Evaluating effect of operating changes.** Corrosion probes with mild-steel specimens were installed immediately after the primary and secondary condensers of the primary tower of a pipe still which was running crude oil that contained 0.4% sulfur. The crude oil was desalted before being fed to the tower, and both corrosion inhibitor and ammonia were added to the overhead stream at the inlet to the primary condenser.

During the first few days of operation, inhibitor and ammonia were not injected. As a result, the probe after the secondary condenser showed a high corrosion rate of 0.27 in. per year (Fig. 3). The corrosion rate decreased markedly a few hours after injection was begun.

However, during the next 40 days, the operating efficiency of the desalter was erratic and corrosion rates varied widely. The probe reacted so fast to a change in the salt content of the crude oil that sometimes the people reading the probe were aware of poor desalting before the operating people were. When the desalting conditions were brought under control, essentially no corrosion was detected for about 2 weeks.

As that time, a 3-day trial was made to evaluate a low-pH method of operating crude stills (OGJ, June 1, 1959, p. 125). At a pH of 5.2, a corrosion rate of 0.94 in. per year was indicated by the probe in the secondary condenser (0.15 in. per year in the primary condenser), despite continued inhibitor injection. Apparently, the charge to this particular unit was too high in sulfur and salt content—even after desalting—to permit satisfactory operation at low pH.

**Evaluating stream composition.** A probe with a specimen containing 5% Cr and 0.5% Mo was installed in the 750° F. inlet line to the furnace of a catalytic cracking unit to determine the effects of sulfur content of gas oil.

As shown in Fig. 4, corrosion rate decreased during 4 days of operation with low-sulfur oil but increased when high-sulfur oil was started again on the ninth day. As expected, the probe showed that reducing the sulfur content of the gas oil cut corrosion. Nevertheless, the low-sulfur gas oil contained too much sulfur to be processed in 5% Cr 0.5% Mo alloy lines.

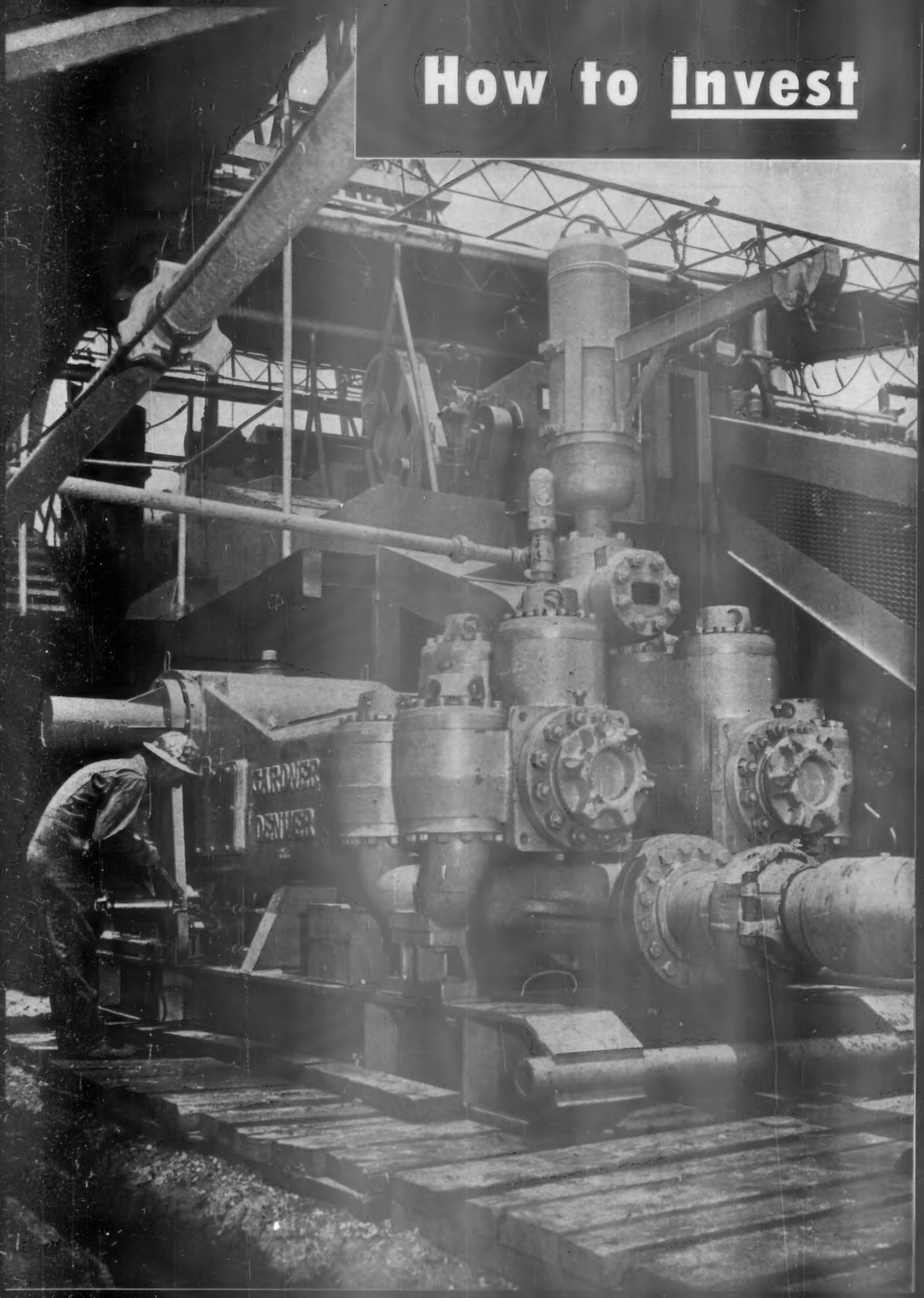
In about 2 weeks, the test showed that either the sulfur content must be reduced or a more resistant alloy must be used.

**Evaluating corrosion inhibitors.** One of the most important applications of probes is in evaluating alternative corrosion-protection measures.

For example, a probe has been used to evaluate a series of commercially available corrosion inhibitors in a light-naphtha condenser. Three inhibitors were tested after a short initial period with no inhibitor. The differences in effectiveness are apparent from the data in Fig. 5.

Corrosion rate decreased to 0.01 in. per year with no inhibitor to 0.02 in. per year with Inhibitor 1 at 11 p.p.m. When the dosage was increased to 22 p.p.m., corrosion rate decreased to 0.01 in. per year. Immediately after changing to Inhibitor 2, corrosion rate dropped to zero. When Inhibitor 3 was introduced, the rate immediately increased to 0.08 in. per year.

# How to Invest



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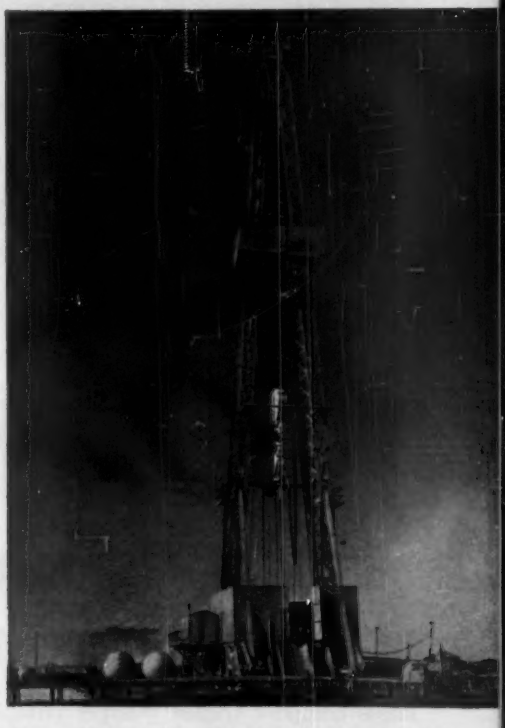

Above — Ideco Full-View Mast. Ask for literature on Ideco Drawworks, Rotaries, Blocks, Masts and Rambler Rigs.

Below — There is real assurance in the rugged strength of J&L Wire Rope.

Gardner-Denver Mud Pump at work in Mississippi. Ask your J&L Supply man for illustrated literature. Parts stocked at near-by J&L Supply stores protect your Gardner-Denver investment wherever you drill.

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Plunger load: 1680 lb.
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to 10.2 gpm at 2140 psi

**PS-25**
**2¼ x 2½ triplex plunger pump**

30 hp input at 500 rpm
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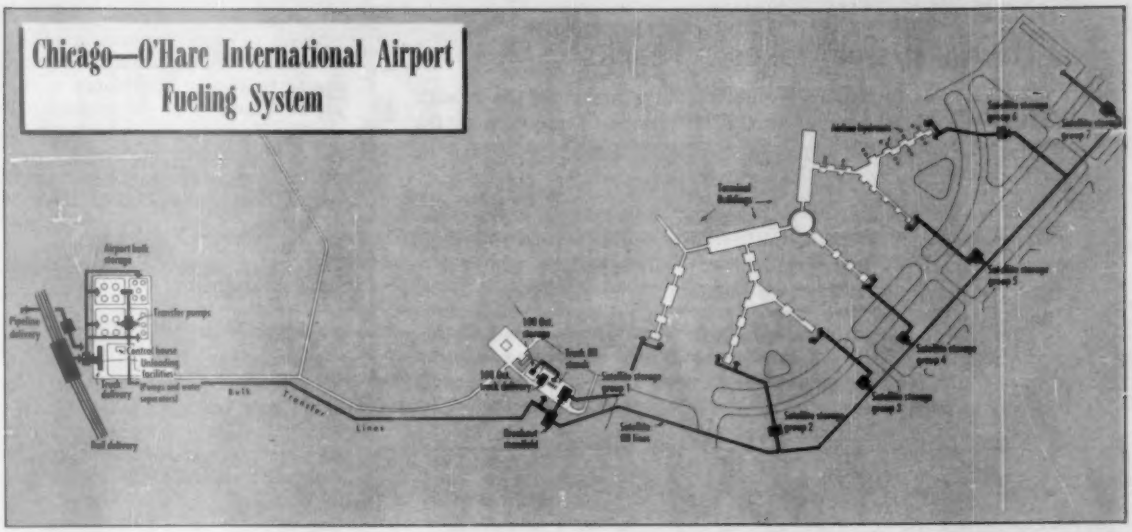


**CONSOLIDATED** into a single system serving many suppliers, yet preserving brand identity, instead of individual systems for individual suppliers, this "jet age" . . .

# Airport features fixed-hydrant fueling

## as O'Hare readies for 600,000,000 gal. per year by '65

A CONSOLIDATED, underground, fixed-hydrant fueling system will be installed at the Chicago-O'Hare International Airport to handle the vast quantity of fuel expected to be required there 5 years hence (600,000,000 gal. annually).

It will be a single system handling the fuel of many suppliers. As such, it contrasts with installations in which individual systems are provided for each supplier.

Cost of the O'Hare system will exceed $6,000,000 and it will be the largest of its kind. It will be owned by the city of Chicago but operated, under contract, by an outside firm.

Reflecting the demand of the jet age, it is estimated that 88% of the 1965 demand at O'Hare will be for turbine fuel and 12% for avgas.

**Design criteria.** The immense quantities of fuel to be handled and the strict quality requirements demanded by jet operations created certain criteria for the design of the O'Hare system. They include:

1. Maximum safety for all persons on the airport, and maximum protection for planes, buildings, and equipment.
2. Fuel-quality control, in terms of cleanliness and dryness throughout all airport fuel-handling operations, far beyond that required for avgas.
3. Preservation of brand identity in contrast to brand commingling as practiced at many military installations and airports abroad.
4. Requirement of short fueling time per jet plane (approximately 20 minutes).
5. Dependability to assure uninterrupted fueling of planes.
6. Flexibility to provide for changes in quantities and types of fuel, and future expansions of the system itself.

### Installation Components

Essentially, the O'Hare installation will consist of the hydrant system's bulk-fuel tank farm, satellite fuel storage, fixed hydrants on airport aprons with provisions for future hydrant installations at hangars, and the system's transfer piping with its related pumping, filtering, and control equipment.

For an economic reason, some plane fueling at O'Hare will be done by tank trucks. Therefore, truck-fill stations will be included. In the main, these will be served from the hydrant system's bulk-fuel storage tanks. However, a small bulk-fuel storage facility, independent of the hydrant system, and holding avgas only, will also supply some truck-fill stations.

**Bulk storage.** The bulk-fuel tank farm will perform important functions other than that of storage. To preserve brand identity, the tankage will be segregated according to suppliers and types of fuel. Bulk-storage facilities will be furnished here for as many as five suppliers of turbine fuel, and three of avgas.

First steps will be taken here to meet the requirement for clean, dry turbine fuel. Fuel in transit from refineries, and at any point up to wing tanks, can collect water and scale particles in sizes down to microns. One sure way to insure clean, dry fuel is to allow adequate fuel-settling time in storage tanks on which top

**BY JAMES P. O'DONNELL**
. . . fueling consultant to Naess & Murphy, architects-engineers for the Chicago-O'Hare International Airport.

## O'Hare's system takes 55 tanks

Sixteen bulk-fuel and 39 satellite tanks make up the storage facilities at this "jet age" airport. This number is required by the volume of fuel to be handled and by the policy of preserving brand identity.

Thirteen of the sixteen floating-roof, bulk-storage tanks—four 500,000-gal., four 375,000-gal. and five 170,000-gal.—will hold turbine fuel. Only three 170,000-gal. tanks will be assigned to avgas. Jet-fuel bulk storage will amount to 4,350,000 gal., avgas, a mere 510,000 gal.

Thirty-five 50,000-gal. satellite tanks will be located in seven groups around the periphery of the airport. Four others will handle 100-octane avgas.

suction is maintained. To this end, at least two bulk storage tanks will be provided for each vendor of turbine fuel. While the fuel in one tank is settling over a predetermined period, settled-out fuel may be withdrawn from the other.

Also, filter separators will be installed in transfer lines upstream and downstream of the bulk tanks as well as downstream of all fuel pumps in the system.

The bulk-fuel tank farm will be isolated in the northeast corner of the airport where ample room for expansion is available. Provisions will be made to receive bulk fuel shipments by pipeline, tank truck, and rail.

For safety reasons, and to insure uninterrupted airline schedules, special fire-prevention precautions will be taken. All tanks will be adequately spaced and diked. A foam system consisting of a foam pump house and a network of foam piping, connecting foam houses around the periphery of tank dikes, will be installed.

A system to provide water for foam and cooling water for the storage tanks, in case of fire, will be included. The hazard of vapor accumulation will be met by the use of properly sealed floating-roof tanks. Special design precautions have been taken throughout the system to prevent the excessive accumulation of electrostatic charges wherever flammable vapors may be present.

**Satellite storage.** Fuel brand identity could be preserved by running individual transfer lines from the bulk farm all the way to airline user hydrants at gate positions, a minimum distance of 2 miles. Since 14 large-volume airline users must be served, some requiring two grades of fuel, this method would be costly. It would require many long, large-diameter fuel-transfer lines to keep pressure drops within reason, and flow velocities low in order to avoid severe shocks in the piping.

Moreover, any future expansion would magnify these problems. The O'Hare installation will avoid these by using horizontal underground satellite fuel-storage tanks located along the western periphery of the terminal area where ample room for future expansion exists.

**Maintaining brand identity.** Eight trickle-feed underground fuel-transfer lines from the bulk farm, segregated according to suppliers and their grades of fuel, will lead into the satellite area. Here, the matter of maintaining brand identity is fully satisfied. The problem now becomes one of providing operating storage for each large-quantity airline fuel user according to daily need, brand preference, and types of fuel required.

To do this, the eight transfer lines—five carrying turbine fuel, and three carrying 115-octane avgas—from bulk storage will be manifolded upstream of the satellite area. Lines from the manifold feed thirty-five 50,000-gal. underground satellite fuel-storage tanks. The tanks will be arranged in seven groups with the number of tanks assigned to an individual user based on that user's fuel requirement for 24 hours. Under automatic level control, fuel of the desired brand and grade will be pumped from the bulk storage tanks to the satellite tanks as required.

Safety in this area will be assured by several means. All satellite tanks will be underground. Because the satellite system is near plane-fueling points, shock pressures which would be set up in transfer piping connecting the satellite storage tanks with the fixed hydrants under conditions of emergency shutdown will be kept within limits which can be handled by standard surge suppressors. The dissipation of air-vapor mixtures within the tanks will be handled by atmospheric venting in accordance with accepted practices of the petroleum industry. To overcome the possible hazard from vapors vented to the atmosphere, the satellite tanks will be well spaced over about a mile and a half of the periphery. Fire protection in the satellite area will consist of portable foam-making equipment, and a fire-water system.

### Apron Hydrant Fueling System

On demand of an individual airline user, fuel will be transferred automatically from the satellite tanks to fixed hydrants at fueling points on the terminal's aprons. Fueling carts will be connected to the hydrants and to plane wing tanks to meter and dispense fuel at rates up to 1,200 g.p.m. per plane. At this rate, jet airliners can be fully fueled in approximately 20 minutes.

All satellite tanks in an airline fuel-grade group will be manifolded to underground transfer lines. These will run to the proper apron headers at gate positions assigned to that airline. Under a change in operating conditions, some major airline fuel users may require one grade of turbine fuel only, two grades of turbine fuel, or one grade of turbine fuel and avgas. To provide this flexibility, two complete hydrant systems will be installed for these users.

A controller for starting the fueling pumps in sequence on increased demand will be used for each fuel user's system. When flow starts into a plane, the pressure in the piping will drop, and a pressure switch in the line will actuate the first pump at that user's satellite tanks. As flow increases, additional satellite pumps will be started at predetermined increments of flow. As flow demand decreases, the cycle reverses.

**Truck-fill area.** Some planes will belong to short-run airlines while others will be "feeders." Many will be small-quantity fuel users and their demand would not justify installing hydrant facilities. These will be fueled by tank trucks from a truck-fill area. Piping takeoffs at the manifold upstream of the satellite storage area will lead to truck-fill stands. Provision will be made for top and bottom loading of tank trucks.

There will be some demand for 100-octane avgas. The amount is small, and this fuel will be stored in the tank-truck area and delivered to users by truck. This storage will include four 50,000-gal. horizontal underground tanks, and tank-truck-filling equipment.

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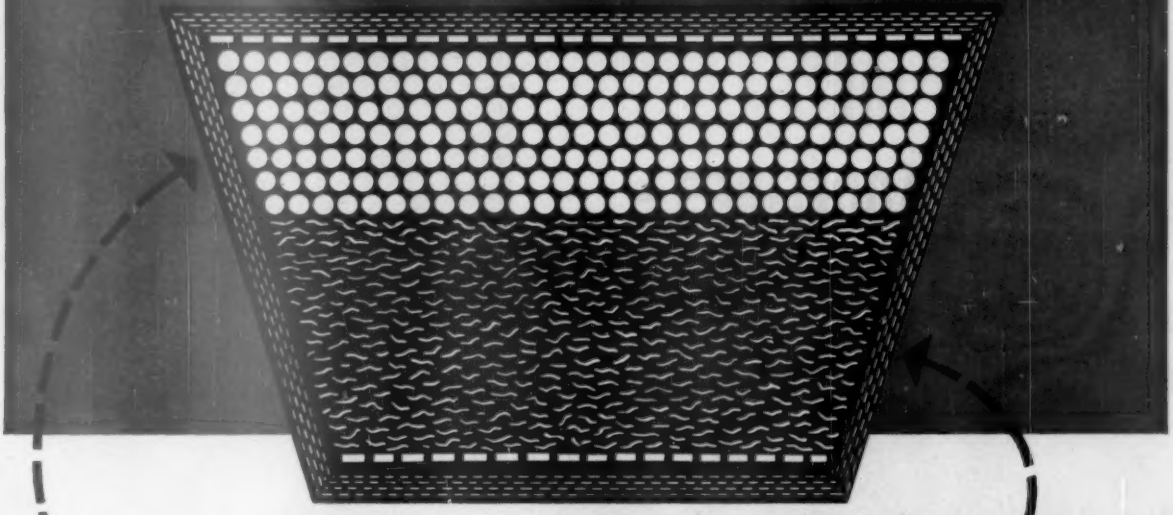

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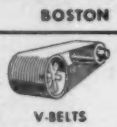
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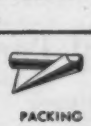
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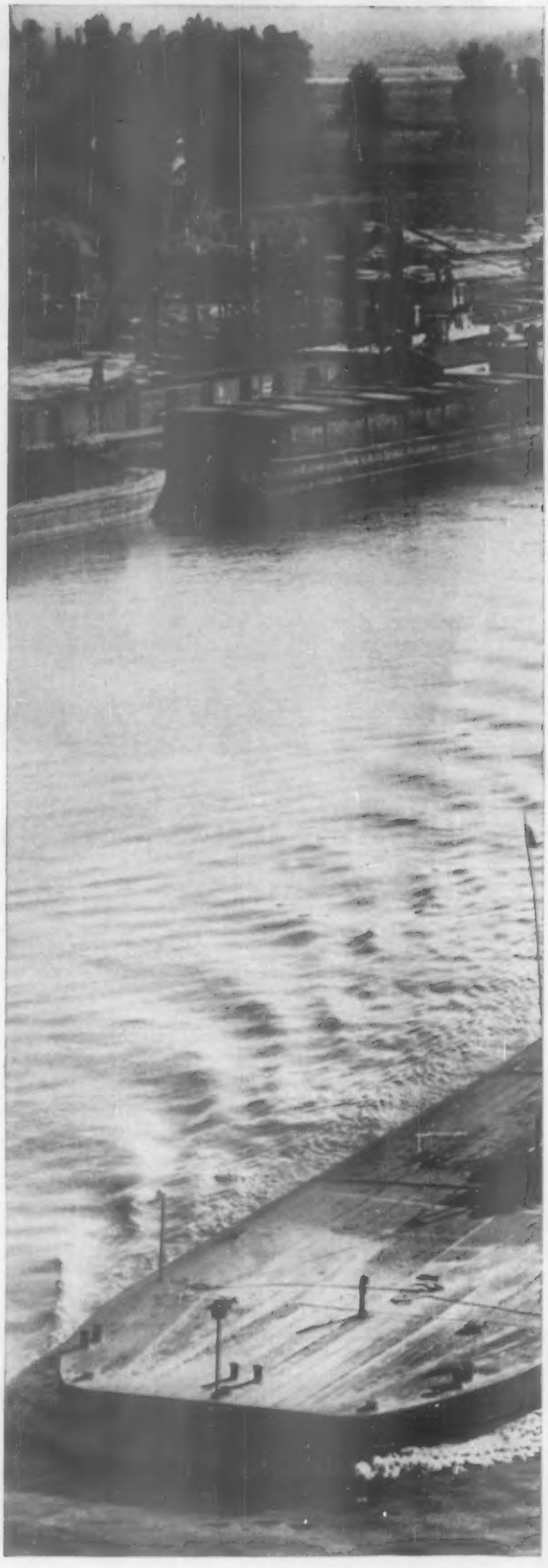
# ARMOUR FUEL OIL ADDITIVES –

## *How they protect against sludge from refinery to furnace*



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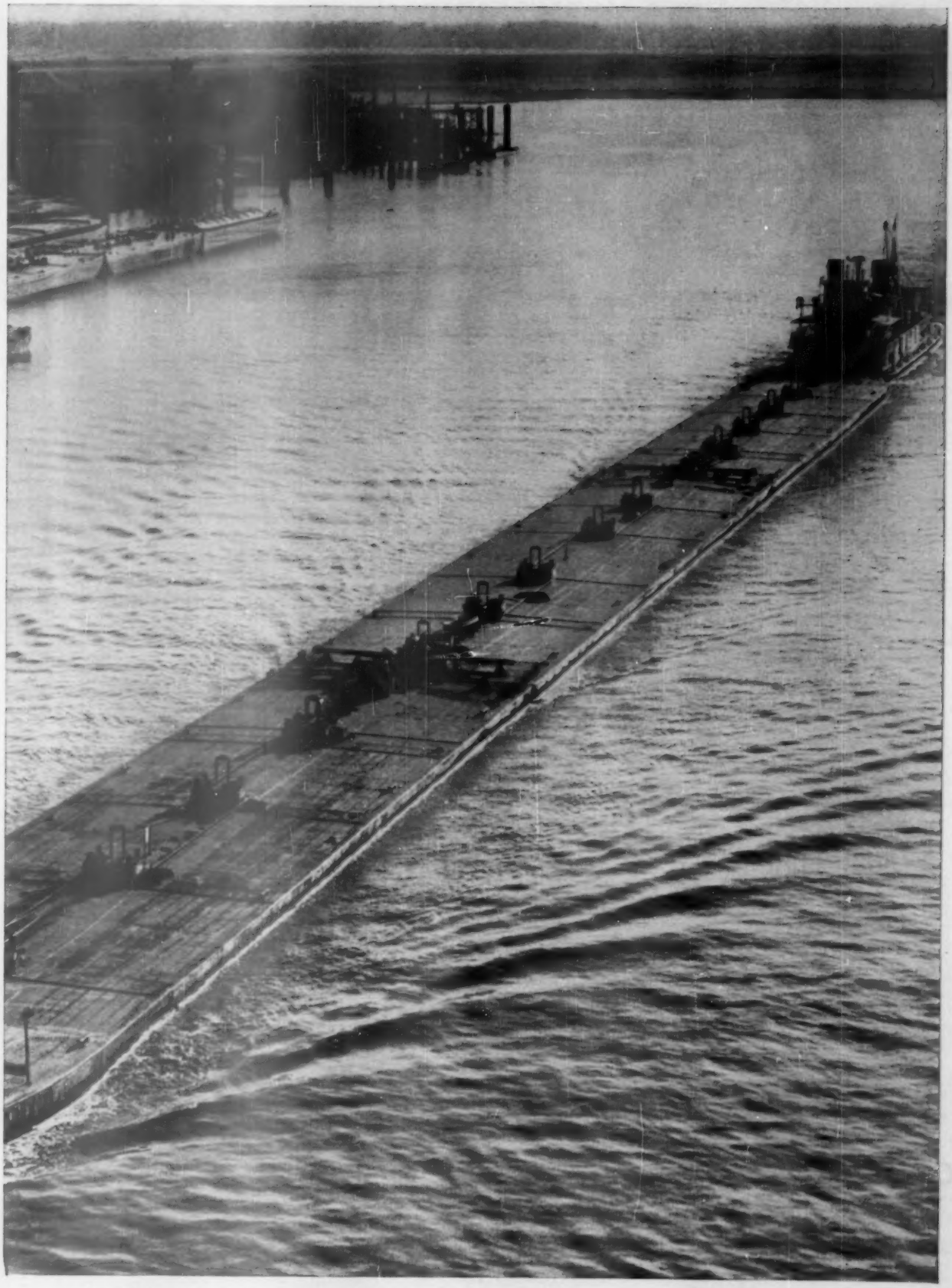
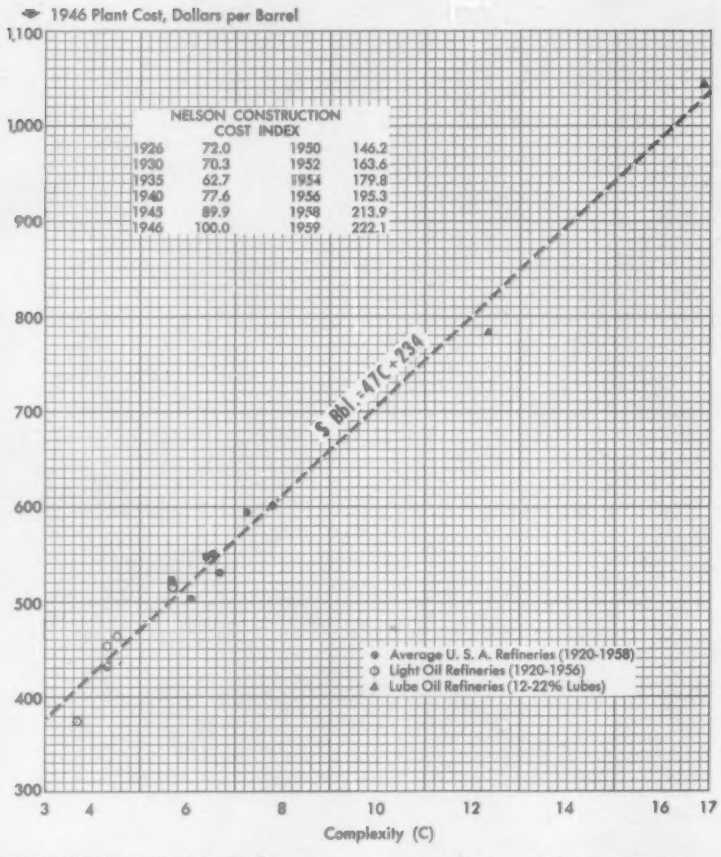


# How complexity of a refinery affects costs of processing

BY W. L. NELSON
Technical Editor and Petroleum Consultant

THE COMPLEXITY of a refinery can be judged by comparing the refinery with one which conducts only crude distillation (along with auxiliaries needed for utilities, etc.). Thus complexity may be considered as the number of times a refinery is more complex than a crude distillation refinery. The factors are tabulated in the first column of Table 1 (see Questions on Technology, "How to Describe Refining Completely," March 14, 1960, p. 189). The capacity of each plant operation is multiplied by its appropriate factor.

The 1946 costs of a number of refineries (see Table 1) were compared using complexity as the basis as shown in Fig. 1. Costs at other years can be estimated by use of the Nelson Refinery Construction Cost Index which is published in the first issue each month of The Oil and Gas Journal.




**APPROXIMATE 1946 COST** of refineries constructed in the United States, as a function of their complexity. Fig. 1.

**TABLE 1—PROCESSING CONDUCTED IN TYPICAL REFINERIES AS PERCENTAGE OF CRUDE OIL CAPACITY.**

| Operation | Complexity factor | 1920* Ave. U.S. | 1920* L.O. | 1930* Ave. U.S. | 1930* L.O. | 1940 Ave. U.S. | 1946* Ave. U.S. | 1946* L.O. | 1950* Ave. U.S. | 1950* L.O. | 1956* Ave. U.S. | 1956* L.O. | 1958 Ave. U.S. | 1956 12% Lube | 1956 22% Lube |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Crude distillation | 1 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100:0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Thermal cracking | 3 | 13.1 | 18.8 | 37 | 40.7 | 44.1 | 32.9 | 33.9 | 26.7 | 26.2 | 11.0 | 18.9 | 7.1 | .... | .... |
| Thermal reforming | 3 | .... | .... | 2 | 2.1 | 4.6 | 5.6 | 5.8 | 5.5 | 4.6 | 4.0 | 3.6 | 2.9 | .... | .... |
| Viscosity breaking | 2 | .... | .... | .... | .... | 1.0 | 2.0 | 3.7 | 3.2 | 4.1 | 7.4 | 5.3 | 7.3 | 13 | .... |
| Coking | 8 | .... | .... | 3 | 3.1 | 1.6 | 1.8 | 1.9 | 2.3 | 2.5 | 4.7 | 3.5 | 5.1 | .... | .... |
| Cat. cracking | 4 | .... | .... | .... | .... | 3.1 | 19.1 | 19.5 | 24.8 | 28.2 | 41.4 | 39.8 | 43.5 | 40 | 38 |
| Cat. reforming | 3 | .... | .... | .... | .... | .... | .... | .... | 1.0 | 1.0 | 10.3 | 11.3 | 15.8 | 20 | 18 |
| Polymerization | 4 | .... | .... | .... | .... | 1.3 | 1.4 | 1.5 | 1.2 | 1.1 | 1.6 | 1.4 | 1.5 | 1.9 | .... |
| Alkylation | 8 | .... | .... | .... | .... | .... | 1.2 | 1.2 | 1.7 | 1.3 | 2.8 | 2.9 | 3.2 | 2.9 | 5.3 |
| Hydrogen treating | 4 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 4.8 | 5.3 | 13.8 | .... | .... |
| Vacuum flashing | 1 | .... | .... | .... | .... | .... | 4.1 | 5.9 | 6.2 | 7.6 | 14.1 | 19.4 | 24.1 | .... | .... |
| Vacuum distillation | 4 | .... | .... | 0.5 | .... | 5.1 | 5.1 | .... | 5.1 | .... | 5.1 | .... | 5.1 | 40 | 40 |
| Lube manufacture | 50 | 5.7 | .... | 3.7 | .... | 2.8 | 2.7 | .... | 2.6 | .... | 2.0 | .... | 1.8 | 12 | 22 |
| Asphalt | 2 | 4.7 | 5.0 | 3.8 | 4.0 | 2.2 | 2.6 | 5.3 | 2.8 | 5.8 | 3.0 | 6.1 | 3.0 | .... | .... |
| Light-oil treating | †1 | 74.0 | 100.0 | 87.0 | 90.0 | 70.0 | 70.0 | 75.0 | 75.0 | 80.0 | 75.0 | 85.0 | 80.0 | 70 | 80 |
| Naph. lubes or Specialties | 20 | 1.0 | .... | 3.0 | .... | 3.0 | 4.0 | .... | 4.0 | .... | 3.0 | .... | 3.0 | 1 | 1 |
| Complexity | .. | 6.02 | 3.66 | 6.57 | 4.31 | 5.7 | 6.42 | 4.31 | 6.62 | 4.54 | 7.25 | 5.71 | 7.81 | 12.40 | 17.08 |
| 1946 cost, $/bbl. | .. | 501 | 373 | 550 | 430 | 520 | 549 | 452 | 530 | 462 | 593 | 517 | 600 | 783 | 1050 |

*Nelson, W. L., The Oil and Gas Journal, December 9, 1957, p. 137.
†Ranges up to a value of 2 during the early years (1920-1935).

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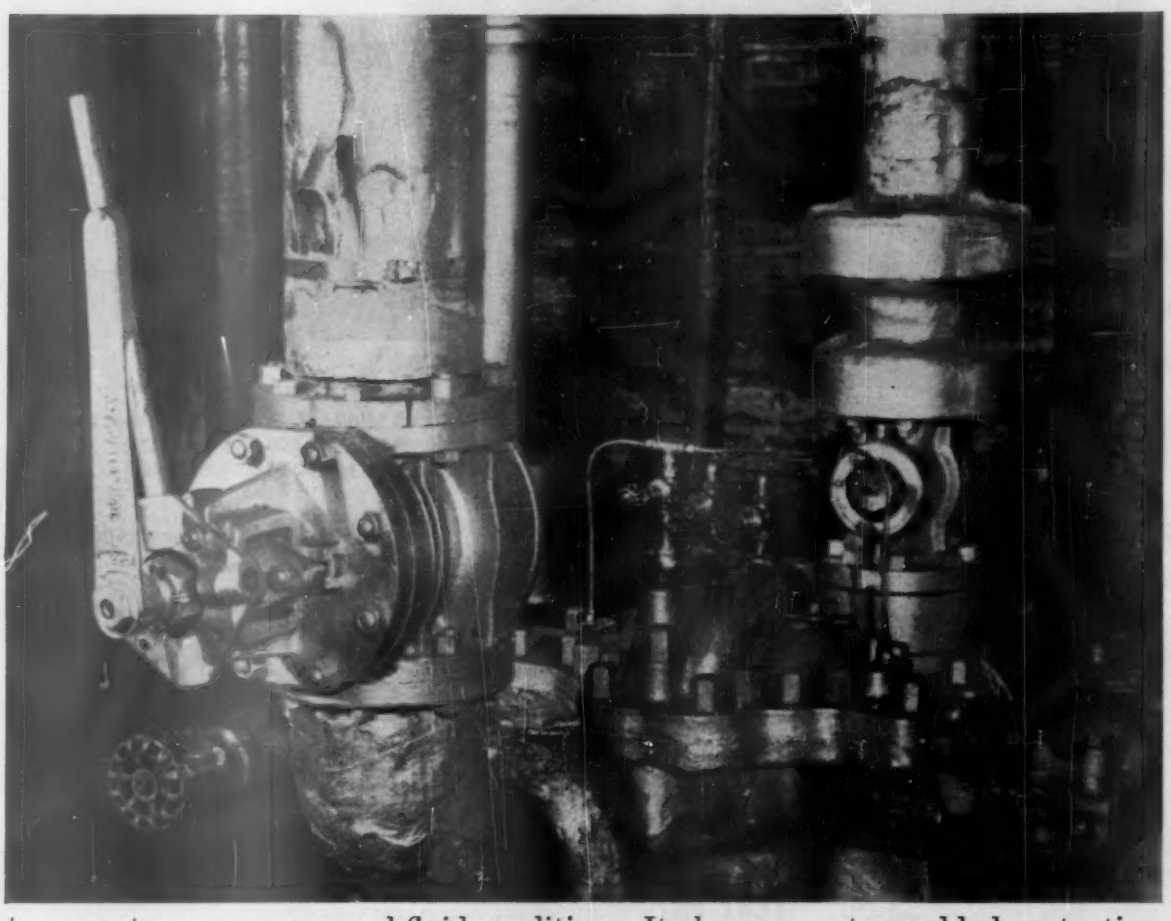

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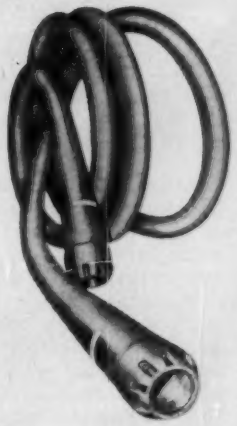

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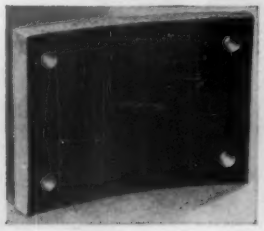

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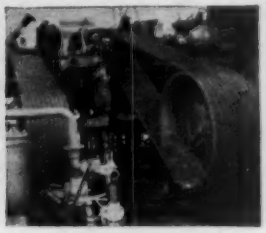

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# Surfactant slugs in water flooding—

## *How much? What concentration?*

**BY CARL E. JOHNSON, JR.**
California Research Corporation,
La Habra, Calif.

● Objective is to maintain a relatively high concentration of surface-active material at the flood front. Here is a mathematical method for finding the amount of surfactant needed, and the best initial concentration to use.

PRESTON AND CALHOUN[1] were the first to propose injection of surfactant slugs as a method for increasing recovery efficiency of water flooding in petroleum reservoirs.

The process, generally known as surfactant slug flooding, consisted of injecting a slug, or batch, of surfactant solution and moving this through the reservoir by continued injection of plain water. This idea represented an advance over previous thinking which had assumed that **all** the water injected should be treated with surfactant.

These authors showed how chromatographic theory could be applied to find the volume of water needed to move the slug through the reservoir, and the weight of surfactant required to prevent the maximum concentration in the slug from falling below the injection concentration. In spite of the progress which their work made toward reducing earlier estimates of the weight of surfactant required, still the total volume of fluid needed to move the slug through the reservoir was generally found too large to be economically practical. This was due in part to the fact that they were dealing with relatively dilute solutions. This was necessary, for when concentrated, more surfactant was needed to keep slug concentration from falling below injection concentration. This restriction was not needed in the oil-recovery process, but was necessary only because the calculational methods they developed could not handle the case in which concentration in the slug was allowed to fall below the injection value. Economics of the process are improved if this restriction is removed. It is the purpose of this paper to show how the calculational methods can be extended to apply in its absence.

### Dependence on Adsorption

Behavior of a surfactant slug as it moves through a porous adsorbent depends upon its adsorption isotherm. The adsorption of a number of surfactants from solution onto solid surfaces has been found to closely follow an equation of the Langmuir type.[2 3 4]

$$M = \frac{k\,a\,C}{1 + kC} \qquad (1)$$

For this reason, an adsorption isotherm of this form has been chosen to illustrate the discussion which follows.

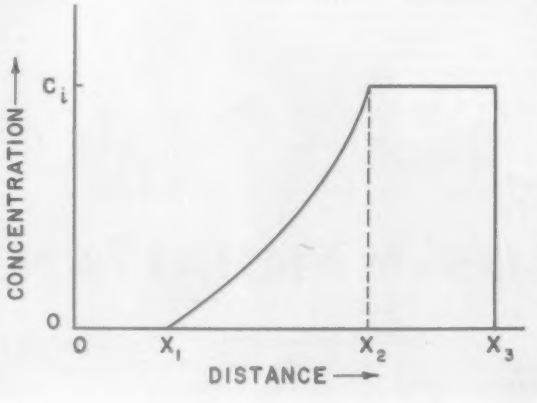
In this equation, M is the weight of surfactant adsorbed and C is the concentration of surfactant in solution in equilibrium with the adsorbed material. If, in addition, M is defined as the weight of surfactant absorbed per unit volume of pore space, and if units of weight and volume are not varied, the equations which follow are complete and do not require inclusion of the conversion factor used by Preston and Calhoun. The constant a is the maximum adsorptive capacity per unit volume of pore space, while k is the reciprocal of that concentration in solution which is in equilibrium with an adsorption of one-half a.

It has been shown[1] that a moving zone of surfactant, whose adsorption is given by Equation 1, will exhibit a concentration profile of the shape shown in Fig. 1. The zone may be thought of as consisting of two parts separated by the point $X_2$. The part to the right is of constant concentration equal to the concentration, $C_i$, at which it was injected and is characterized by a sharp leading edge. The one to the left is of variable concentration and will be referred to as the trailing edge.

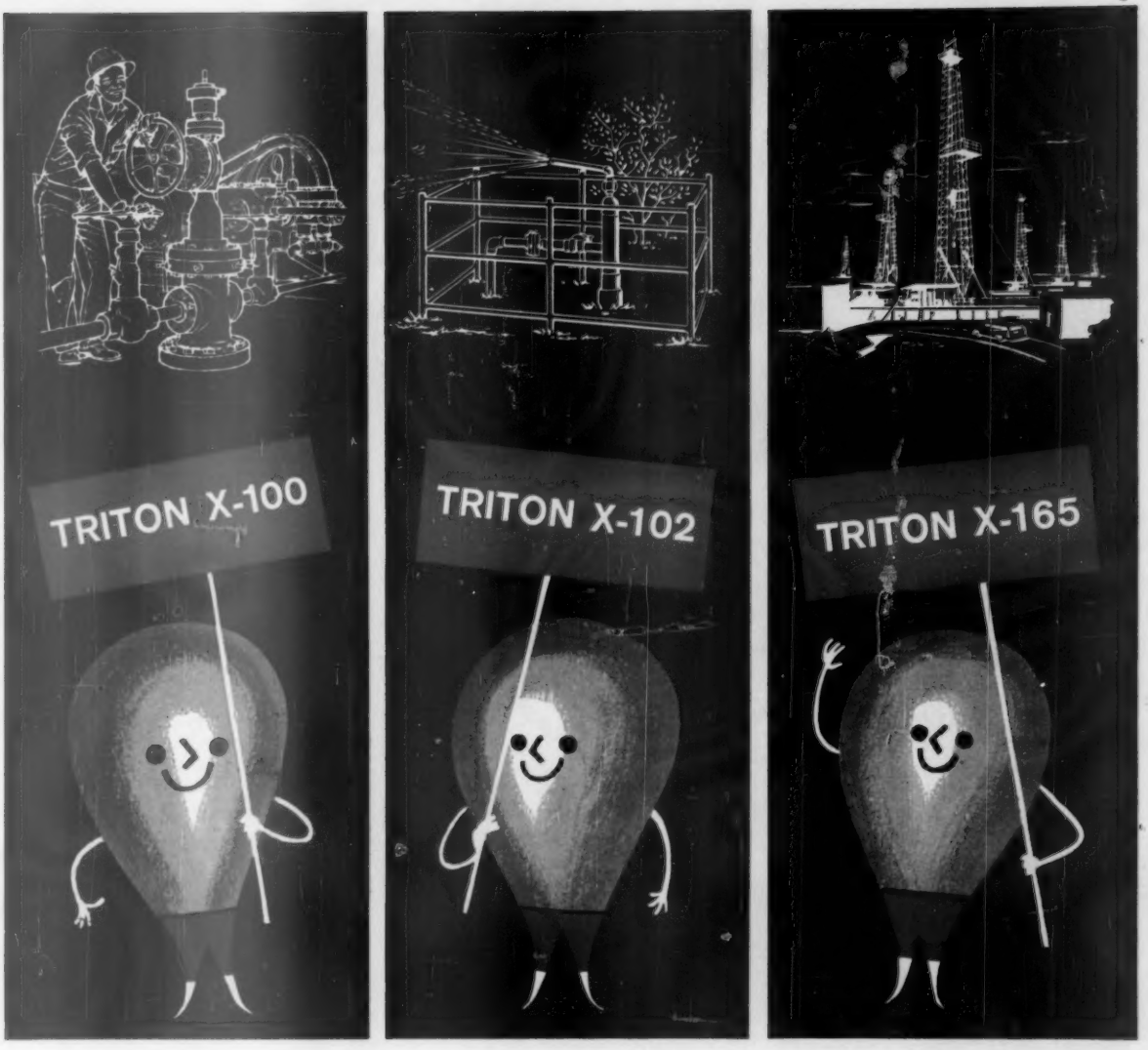
As the whole zone is moved to the right by injection of plain water, the trailing edge lengthens and the zone of constant concentration diminishes. For any given volume of surfactant slug, a volume of injected water will be reached at which the point $X_2$ overtakes $X_3$. When $X_2$ equals $X_3$, and $X_3$ is the total length of the system, then the volume of the surfactant slug is that which Preston and Calhoun discussed. It is the minimum necessary to maintain the concentration, $C_i$, through a complete traverse of the system.

If the slug is required to move farther, its maximum concentration at the leading edge will gradually decrease while the trailing edge continues to spread. The method proposed by Preston and Calhoun does not apply to declining concentration.

According to Preston and Calhoun the minimum volume of surfactant slug, $V_s$, per unit volume of pore space is given by Equation 2, eval-




**GENERALIZED** concentration distance profile for a moving zone of surfactant whose adsorption is described by the Langmuir equation. Fig. 1.

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uated at the injection concentration $C_i$ which is to be maintained:

$$V_s = (M/C) - (dM/dC)$$
$$= \frac{k^2 a C}{(1 + kC)^2} \quad (2)$$

It follows that the weight of surfactant, W, required to make up a slug of this volume and concentration is given by Equation 3, evaluated at $C_i$:

$$W = C\,[(M/C) - (dM/dC)]$$
$$= \frac{k^2 a C^2}{(1 + kC)^2} \quad (3)$$

The total volume of water plus surfactant solution, $V_T$, which must be injected per unit volume of pore space is given by Equation 4, evaluated at $C_i$:

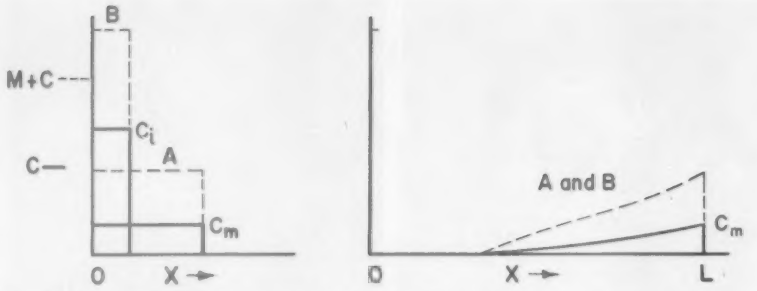
$$V_T = 1 + (M/C)$$
$$= 1 + \frac{ka}{1 + kC} \quad (4)$$

Once a value of $C_i$ is chosen, Equations 3 and 4 allow calculation of the quantities responsible for the two principal costs involved in surfactant flooding. Since $V_T$ decreases with increasing injection concentration while W increases, total costs may be expected to differ for each value of $C_i$. Johnson[5] has published one simple method for finding the best injection concentration when the effect of surfactant concentration on oil recovery is known.

The process dealt with still requires, however, that the weight of surfactant be large enough so that whatever the injection concentration, it will be maintained through the entire length of the reservoir. Because of this restriction, the most economic injection concentrations are generally low and the corresponding values of $V_T$ too large. The situation is improved if this restriction is dropped.

### The Concentrated Slug

Taber[6] was the first to suggest that a significant decrease in $V_T$ could be achieved, without a large increase in W, by injecting a small slug of surfactant at high concentration and allowing the concentration at its leading edge to decline as it moves through the reservoir. In the absence of equations describing the movement of such slugs, he suggests that the weight of surfactant be chosen such that the slug will travel a "reasonable" distance before the concentration at its leading edge falls below the injection concentration. This procedure does not guarantee that the weight chosen will be sufficient to prevent the leading edge concentration from falling below the minimum concentration required for oil recovery. The suggestion has merit, however, and it will be shown how chromatographic theory can be used to predict quantitatively the behavior of such concentrated surfactant slugs.




**INITIAL AND FINAL DISTRIBUTION** of concentrated and dilute slugs containing equal weights of surfactant. Fig. 2.

It will be assumed that the constants of the adsorption isotherm, k and a, have been measured and that experiment has indicated a minimum surfactant concentration, $C_m$, which is effective in recovering oil. The first problem then is to determine what weight of surfactant must be injected at high concentration so that the slug will traverse the reservoir before the concentration at its leading edge falls below $C_m$. The second is to determine what total volume of fluid must be injected to move the slug through the reservoir.

Fig. 2 shows two surfactant slug profiles. Slug A has been injected as suggested by Preston and Calhoun at concentration $C_m$. Its concentration profile is shown by the solid line; and its total surfactant profile, both surfactant adsorbed and in solution, by the dashed line. The area under the dashed line is proportional to the total weight of surfactant injected and must remain constant as the slug moves through the reservoir. The weight of surfactant has been chosen, using Equation 3, so that the slug will just traverse the length of the reservoir, L, before its concentration drops below $C_m$. The slug profile at point L is shown on the right of Fig. 2.

Slug B contains the same weight of surfactant, but was injected at a concentration $C_i$, higher than $C_m$. Both slugs have a range of concentrations in common, from O to $C_m$, in their trailing edges. Preston and Calhoun have shown that the volume of water per unit volume of pore space, $V_w$, which must be injected behind a surfactant slug to move any concentration C on the trailing edge to the end of the reservoir is given by Equation 5.

$$V_w = 1 + (dM/dC)$$
$$= 1 + \frac{ka}{(1 + kC)^2} \quad (5)$$

Thus the volume of water injected behind slug A to move concentration $C_m$ on the trailing edge to point L is exactly the same as required to move $C_m$ on the trailing edge of slug B to point L. Furthermore, after the injection of this volume of water, all other concentrations lower than $C_m$ will be distributed in exactly the same way for both slugs. This being so, the sum of the surfactant adsorbed and in solution must also be distributed in the same way for both slugs and, since the weight of surfactant is the same in each, the area under the dashed line for both distributed slugs must be the same. Thus, the leading edges of both will be found at point L.

It follows that the weight of surfactant required to sweep the length of the reservoir maintaining a concentration of at least $C_m$ is given by Equation 3, evaluated at $C_m$, regardless of whether the injection concentration is $C_m$ or higher.

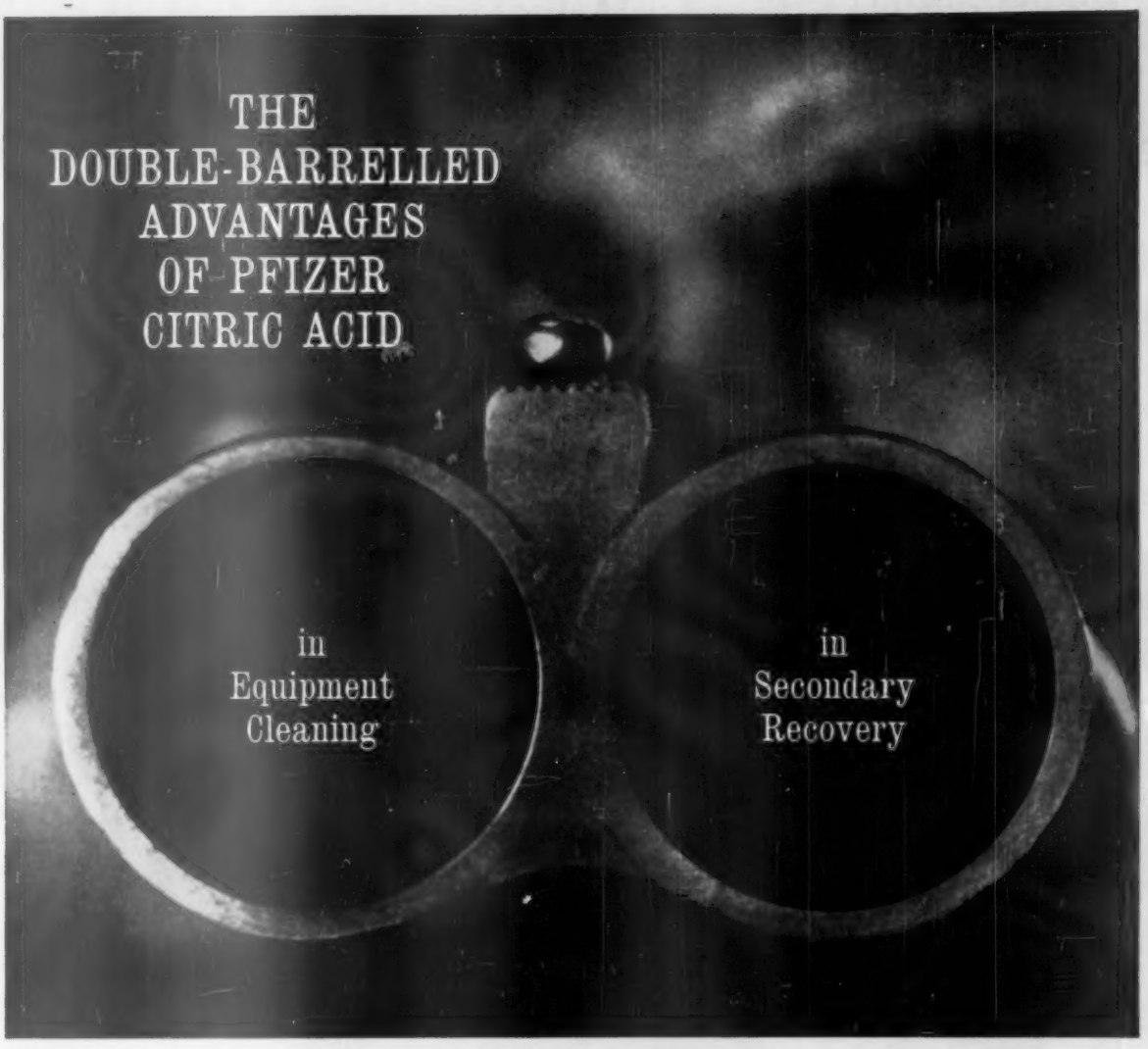
The total volume of fluid injected is equal to the volume of water injected behind the slug plus the volume of the slug itself. This is expressed by:

$$V_T = V_W + W/C_i \quad (6)$$

Here $V_W$ is obtained from Equation 5 and W from Equation 3, both evaluated at $C_m$, and $C_i$ is the injection concentration. It can be seen that the reduction in $V_T$ is due entirely to reduction in volume of the surfactant slug achieved by preparing it in more concentrated form.

### Graphical Representation

In a linear-flow system, the weight of surfactant required to sweep some fraction, X/L, of the total length of the reservoir at a concentration not less than C is just X/L times the weight required to sweep the full

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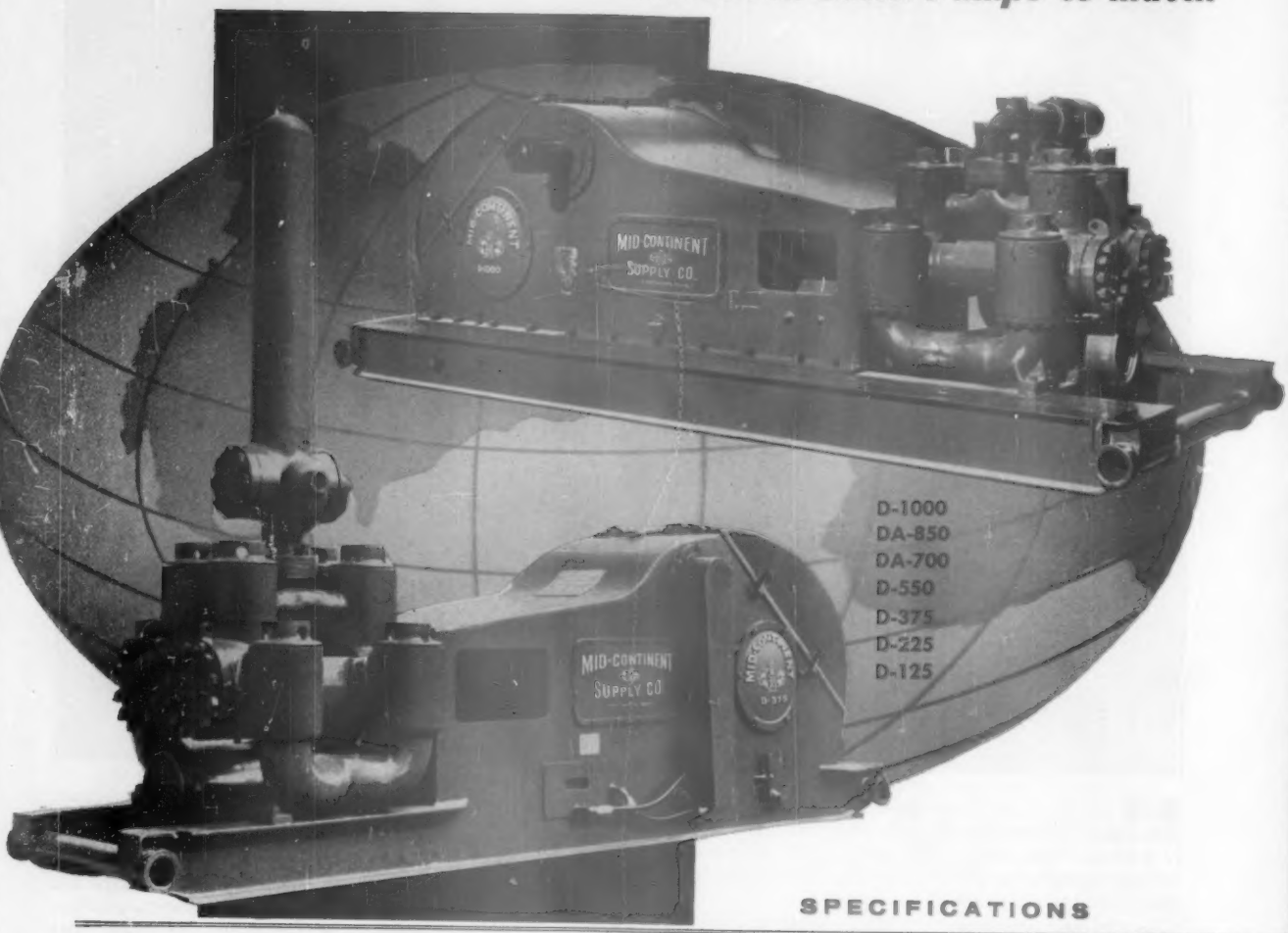


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| Fluid End Test Pressure | 3500 psi | 3500 psi | 4000 psi | 6000 psi |
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| Discharge Manifold | 3" Female | 3" Female | 4" Female | 4" Female |
| Gear Ratio | 4.96:1 | 5.43:1 | 5.04:1 | 5.04:1 |
| Gear Face | 5" | 9" | 11¼" | 13" |
| Pinion Shaft Extension (Clear) | 9½" | 9⅞" | 12⅛" | 13⅛" |
| Bearing | Roller | Roller | Roller | Roller |
| Keyway | 1" x ½" | 1" x ½" | 1¼" x ⅝" | 1¼" x ⅝" |
| Eccentric Drive Bearings | Roller | Roller | Roller | Roller |
| Main Shaft Bearings | Self Align | Self Align | Self Align | Self Align |
| Crosshead Bearings | Double Needle Roller | Double Needle Roller | Double Needle Roller | Double Needle Roller |
| Length—Overall | 11'—2" | 12'—6" | 14'—8" | 16'—8" |
| Width | | | | |
| Overall—Inc. Shaft Ext. | 4'—½" | 4'—1⅝" | 4'—8" | 6'—8¼" |
| Fluid End | 3'—8½" | 3'—8½" | 4'—1" | 4'—6½" |
| Power End—Inc. Shaft Ext. | 4'—½" | 4'—½" | 4'—4¹⁵⁄₁₆" | 6'—5" |
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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-1000 | | | | 8¼" | 8" | 7¾" | 7½" | 7¼" | 7" | 6¾" | 6½" | 6¼" | 6" | 5¾" |
| | 60 | 1000 | G P M Output | 933 | 874 | 817 | 760 | 705 | 653 | 603 | 553 | 507 | 462 | 419 |
| | 50 | 833 | G P M Output | 778 | 728 | 680 | 633 | 588 | 545 | 503 | 461 | 423 | 385 | 349 |
| | 40 | 667 | G P M Output | 623 | 582 | 544 | 506 | 470 | 436 | 402 | 369 | 338 | 308 | 279 |
| | | | Gallons per Revolution | 15.56 | 14.57 | 13.60 | 12.66 | 11.75 | 10.89 | 10.05 | 9.22 | 8.45 | 7.71 | 6.99 |
| | | | Max. Disch. Pressure | 1042 | 1166 | 1793 | 1917 | 2060 | 2229 | 3418 | 2635 | 2371 | 2153 | 3480 |
| DA-850 | | | | 8¼" | 8" | 7¾" | 7½" | 7¼" | 7" | 6¾" | 6½" | 6¼" | 6" | 5¾" |
| | 60 | 850 | G P M Output | 933 | 874 | 817 | 760 | 705 | 653 | 603 | 553 | 507 | 462 | 419 |
| | 50 | 708 | G P M Output | 778 | 728 | 680 | 633 | 588 | 545 | 503 | 461 | 422 | 385 | 349 |
| | 40 | 567 | G P M Output | 623 | 582 | 544 | 506 | 470 | 436 | 403 | 369 | 338 | 308 | 279 |
| | | | Gallons per Revolution | 15.56 | 14.57 | 13.60 | 12.66 | 11.75 | 10.89 | 10.05 | 9.22 | 8.45 | 7.71 | 6.99 |
| | | | Max. Disch. Pressure | 1338 | 1418 | 1515 | 1629 | 1758 | 1905 | 2065 | 2240 | 2440 | 2660 | 2954 |
| DA-700 | | | | 8¼" | 8" | 7¾" | 7½" | 7¼" | 7" | 6¾" | 6½" | 6¼" | 6" | 5¾" | 5½" |
| | 65 | 700 | G P M Output | 909 | 853 | 796 | 742 | 688 | 640 | 591 | 544 | 499 | 456 | 414 | 374 |
| | 55 | 592 | G P M Output | 769 | 721 | 674 | 628 | 584 | 541 | 500 | 460 | 422 | 386 | 350 | 317 |
| | 45 | 485 | G P M Output | 630 | 590 | 551 | 514 | 477 | 443 | 409 | 377 | 346 | 316 | 287 | 259 |
| | | | Gallons per Revolution | 13.99 | 13.10 | 12.25 | 11.42 | 10.61 | 9.84 | 9.09 | 8.37 | 7.68 | 7.02 | 6.37 | 5.76 |
| | | | Max. Disch. Pressure | 1120 | 1197 | 1281 | 1374 | 1478 | 1593 | 1726 | 1878 | 2044 | 2236 | 2483 | 2727 |
| D-550 | | | | 7½" | 7¼" | 7" | 6¾" | 6½" | 6¼" | 6" | 5¾" | 5½" | 5¼" | 5" | 4¾" |
| | 65 | 550 | G P M Output | 751 | 699 | 646 | 600 | 553 | 508 | 464 | 423 | 383 | 346 | 309 | 275 |
| | 55 | 466 | G P M Output | 636 | 592 | 549 | 508 | 468 | 430 | 393 | 358 | 325 | 293 | 262 | 233 |
| | 45 | 381 | G P M Output | 520 | 484 | 449 | 415 | 382 | 352 | 321 | 293 | 266 | 239 | 214 | 190 |
| | | | Gallons per Revolution | 11.56 | 10.76 | 9.98 | 9.23 | 8.51 | 7.82 | 7.14 | 6.51 | 5.90 | 5.32 | 4.76 | 4.23 |
| | | | Max. Disch. Pressure | 1057 | 1146 | 1235 | 1336 | 1449 | 1577 | 1727 | 1894 | 2090 | 2317 | 2580 | 2918 |
| D-375 | | | | 7½" | 7¼" | 7" | 6¾" | 6½" | 6¼" | 6" | 5¾" | 5½" | 5¼" | 5" | 4¾" |
| | 70 | 375 | G P M Output | 723 | 674 | 626 | 581 | 536 | 494 | 472 | 414 | 376 | 341 | 307 | 274 |
| | 60 | 321 | G P M Output | 620 | 577 | 537 | 499 | 460 | 423 | 405 | 355 | 323 | 292 | 263 | 235 |
| | 45 | 241 | G P M Output | 465 | 433 | 403 | 373 | 345 | 318 | 305 | 266 | 242 | 219 | 197 | 176 |
| | | | Gallons per Revolution | 10 338 | 9 638 | 8 948 | 8 294 | 7 663 | 7 056 | 6 743 | 5 913 | 5 378 | 4 867 | 4 379 | 3 915 |
| | | | Max. Disch. Pressure | 744 | 819 | 871 | 939 | 1018 | 1104 | 1156 | 1318 | 1451 | 1660 | 1777 | 1991 |
| D-225 | | | | 7¼" | 7" | 6¾" | 6½" | 6¼" | 6" | 5¾" | 5½" | 5¼" | 5" | 4¾" | 4½" |
| | 70 | 225 | G P M Output | 580 | 539 | 500 | 462 | 426 | 391 | 357 | 325 | 295 | 265 | 237 | 211 |
| | 60 | 193 | G P M Output | 497 | 462 | 429 | 396 | 365 | 335 | 306 | 279 | 252 | 227 | 203 | 180 |
| | 45 | 145 | G P M Output | 373 | 347 | 321 | 297 | 274 | 251 | 229 | 209 | 189 | 171 | 153 | 136 |
| | | | Gallons per Revolution | 8 283 | 7 703 | 7 142 | 6 602 | 6 083 | 5 583 | 5 104 | 4 648 | 4 208 | 3 790 | 3 392 | 3 015 |
| | | | Max. Disch. Pressure | 868 | 907 | 954 | 758 | 789 | 838 | 916 | 1007 | 1111 | 1234 | 1378 | 1531 |
| D-125 | | | | 7¼" | 7" | 6¾" | 6½" | 6¼" | 6" | 5¾" | 5½" | 5¼" | 5" | 4¾" | 4½" |
| | 85 | 125 | G P M Output | 560 | 557 | 509 | 471 | 434 | 399 | 365 | 332 | 301 | 271 | 243 | 216 |
| | 70 | 103 | G P M Output | 458 | 459 | 419 | 388 | 357 | 329 | 300 | 273 | 248 | 223 | 200 | 178 |
| | 55 | 81 | G P M Output | 332 | 361 | 329 | 305 | 281 | 258 | 236 | 215 | 195 | 176 | 157 | 140 |
| | | | Gallons per Revolution | 6 940 | 6 436 | 5 998 | 5 538 | 5 104 | 4 686 | 4 283 | 3 906 | 3 540 | 3 192 | 2 860 | 2 546 |
| | | | Max. Disch. Pressure | 308 | 328 | 357 | 385 | 419 | 456 | 499 | 543 | 604 | 670 | 748 | 840 |

| DA-700 | DA-850 | D-1000 |
|---|---|---|
| 8¼" x 16" | 8¼" x 18" | 8¼" x 18" |
| 2¾"—6 API | 3"—6 API | 3"—6 API |
| 6000 psi | 6000 psi | 6000 psi |
| 10" Male | 12" Male | 12" Male |
| 4" Female | 4" Female | 4" Female |
| 5.05:1 | 5.03:1 | 4.76:1 |
| 14" | 16" | 18" |
| 14" | 15" | 15" |
| Roller | Roller | Roller |
| 1½" x ¾" | 1½" x ¾" | 1½" x ¾" |
| Roller | Roller | Roller |
| Self Align | Self Align | Self Align |
| Double Needle Roller | Double Needle Roller | Double Needle Roller |
| 18'—4½" | 20'—2" | 20'—2" |
| 7' | 8' | 8' |
| 4'—8½" | 6'—6" | 6'—6" |
| 6'—7½" | 6'—4¼" | 6'—4¼" |
| 7' | 8' | 8' |
| 6' | 6'—4½" | 6'—6" |
| 37,500 lbs. | 48,800 lbs. | 50,500 lbs. |

SP2-0

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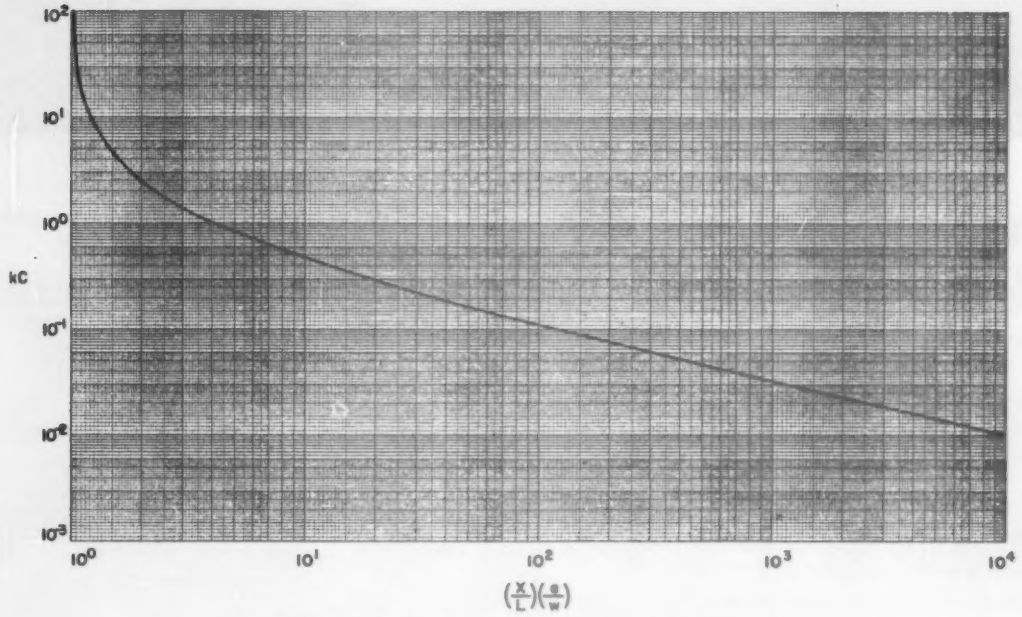


**A GRAPHICAL REPRESENTATION** of Equation 7. Fig. 3.

length. Equation 3 can be modified, therefore, and rearranged to get:

$$[(1 + kC)/kC]^2 = (X/L)\ (a/W) \quad (7)$$

If values of kC are plotted as ordinate vs. values of (X/L) (a/W) from Equation 7, Fig. 3 is obtained. A log-log scale is used merely for convenience. Both ordinate and abscissa in Fig. 3 are dimensionless. The ordinate is equivalent to an adjustable concentration scale and the abscissa to an adjustable distance scale. The curve shows, therefore, the way in which the leading edge concentration of a very small, very concentrated slug will decline as it travels forward. The figure has no particular advantage over the equations already given, except in this pictorial quality and the fact that it is useful in making rapid calculations.

For example, suppose the constants k and a of the adsorption isotherm are known, and that the minimum concentration which must be maintained over the entire length of the reservoir (X/L = 1) is $C_m$, such that $kC_m$ equals $10^{-2}$. Enter the kC scale at $10^{-2}$. Moving to the right, the curve is intersected at a value (X/L) (a/W) of $10^4$. In this example X/L is one, so that a/W is $10^4$ and W is $10^{-4}$ a. The abscissa may now be converted to a fractional distance scale by dividing all its values by $10^4$.

Suppose now the same weight of surfactant is to be injected at concentration $C_i$, 10 times greater than $C_m$.

Enter the kC scale at $10^{-1}$. Moving to the right the injection concentration is maintained until the leading edge of the slug has moved a little more than 1/100 the full length. At this point the curve is intersected and the leading edge concentration declines along the curve until it reaches the end of the reservoir at concentration $C_m$.

It should be noted that concentrating the slug in this manner results in sweeping the reservoir with surfactant at a concentration which is always higher than the concentration which must be maintained, except at the very end. This may be advantageous if some compromise has been made in choosing the minimum concentration, such that it is not high enough to give the best oil recovery possible.

Following the same procedure, however, it is easily seen that concentrating the slug 100 times, rather than 10 times, results in a higher sweep concentration over only about the first 1% of the distance traveled, after which the peak concentration follows the same decline curve as the slug concentrated only 10 times. It appears generally true that, where increases in average sweep concentration are the goal, concentrating the surfactant slug by more than 10 times results in negligible gains.

Fig. 3 can also be used without alteration to represent the transport behavior in a radial flow system simply by changing the label on the horizontal axis to read $(X/L)^2$ (a/W) instead of (X/L) (a/W).

## Summary

It has been shown that the weight of surfactant which must be injected, in order to prevent its concentration falling below some predetermined minimum value before reaching the end of the reservoir, is the same whether it is injected at the minimum concentration or in more concentrated form.

The total volume of fluid which must be injected is less when the surfactant slug is in concentrated form. The difference is exactly equal to the difference in the volumes of the dilute and concentrated slugs.

The concentrated slug sweeps the reservoir at a higher average concentration than a dilute slug of equal surfactant weight. There is not much to be gained by concentrating the slug more than 10 times the minimum concentration which is to be maintained.

The method and conclusions depend upon the usual assumptions involved in the application of chromatographic theory to surfactant flooding. The most important of these are: (1) adsorption - desorption equilibrium is rapid and reversible, (2) adsorption is the only process tending to disperse the surfactant slug, and (3) only one fluid phase is present in the reservoir.

## References

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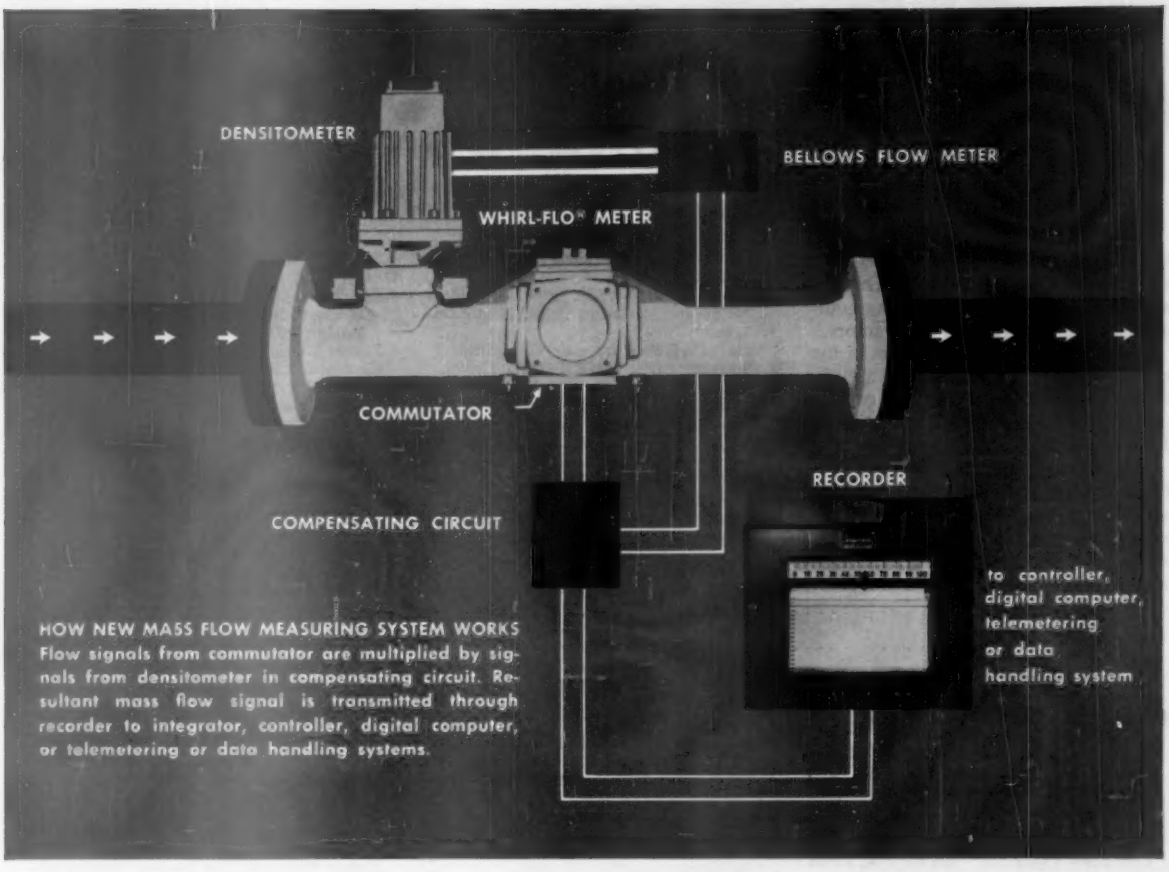
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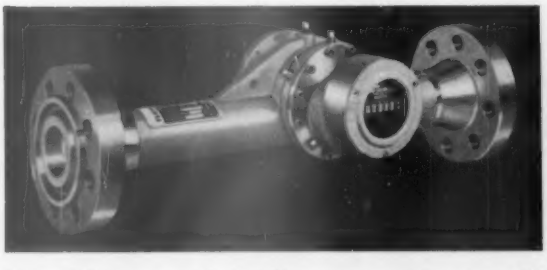

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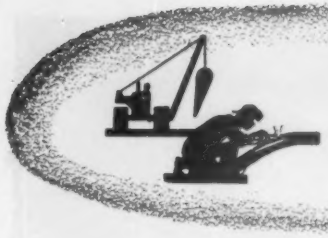

# Monthly Report on PIPELINE CONSTRUCTION

PIPELINE ACTIVITY reported here is compiled from surveys by The Oil and Gas Journal among pipeline companies and construction contractors.

This summary report appears in the last issue of the Journal each month. New construction projects are reported weekly in Pipeline Briefs in the Journal's news section.

Projects are listed in three groups—U. S., Canadian, and Foreign—and according to type of line—crude, products, or natural gas.

★ The star symbol indicates the first appearance of the project in the Journal's survey.

## U. S. Crude Oil Pipelines

**BELLE FOURCHE PIPELINE CO.,** Box 1612, Casper, Wyo.
Project: 103-mile 8-in. line from Fiddler Creek field to Lance Creek, Wyo., and other lines to serve Roset, Miller Creek, and Lone Tree fields.
Status: Approved by Wyoming Public Service Commission.

**CAPE PIPE LINE CO.** (Sun Oil Co., Cities Service Co., Atlantic Refining Co.), Philadelphia.
Project: Line from lower Delaware Bay to Philadelphia.
Status: Proposed.

**CONTINENTAL PIPE LINE CO.,** Drawer 1267, Ponca City, Okla.
★ Project: 21 miles of 8-in. from Grand Isle to Golden Meadow, La.
Status: Proposed.
Completion: December 15, 1960.

**GILLETTE PIPELINE, INC., and A. W. HARTWIG, INC.**
Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
Status: Pending Wyoming Public Service Commission approval.

**GREAT NORTHERN RAILWAY,** St. Paul.
Project: 50 miles of 6 and 10-in. in North Dakota from Minot to Newberg, Wiley, and Glenburn fields, Bottineau County.
Contractor: Curran & Co., Great Falls, Mont.
Completion: November 1, 1960.
Project: About 64 miles from Lignite field, Burke County, North Dakota, to Minot.
Status: Planned.
Completion: 1961.

**GULF REFINING CO.,** Drawer 2100, Houston 1, Tex.
Project: 23 miles of reroute of 10-in. near Carlyle, Ill.
Completion: December 1960.

**INTERNATIONAL OIL PIPELINE CORP.,** New York.
Project: Would own U. S. section of 1,500-mile, 30-in. line proposed by Mid-Continent Pipe Lines, Ltd., from Edmonton, Alta., to Chicago. (See Canada).
Status: Proposed.

**INTERNATIONAL REFINERIES, INC.,** 227 North Colfax Ave., Minneapolis 5, Minn.
★ Project: 3½ and 4½-in. gathering lines in Wiley and Bottineau fields, North Dakota.
Status: Approved by state authorities.

**MATADOR PIPE LINE CORP.,** Denver.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Pending approval of Canadian National Energy Board.

**NORTHWESTERN REFINING CO.,** Box 248, St. Paul Park, Minn.
Project: 4, 6, and 8-in. gathering lines in Glenburn field, Renville and Bottineau counties, North Dakota.
Status: Has state approval.

**SERVICE PIPE LINE CO.,** Box 1979, Tulsa 2, Okla.
Projects: 49 miles of 2 to 16-in. gathering line to connect new leases.
Completion: Summer and fall 1960.

**SHELL PIPE LINE CORP.,** Box 2648, Houston 1, Tex.
Project: 4½ miles of 8-in. and 7 miles of 6-in. from East and West Burrwood fields, Louisiana, to existing 8-in. line near Delta Pipe Line's Southwest Pass station.
Status: Under way.
Contractor: J. Ray McDermott & Co., Inc., Harvey, La.
Completion: October 15, 1960.
★ Project: 1½ miles of 4-in. at Bonnet Carre field, Louisiana.
Status: Planned.
Completion: October 15, 1960.

**STANDARD OIL CO. OF CALIFORNIA,** San Francisco.
Project: 22 miles of 8-in. from Swanson River Unit to Nikiski on Cook Inlet, Alaska.
Status: Under way.
Contractors: Sharman, Allen, Gay & Taylor, Inc., Houston.

## U. S. Products Pipelines

**HUSKY OIL CO.,** Cody, Wyo.
Project: About 100 miles from Cody to the Yellowstone products line west from Billings, Mont.
Contractor: W. E. Claycomb & Son Construction Co., Cody.
Completion: By October 15, 1960.

**MID-AMERICA PIPELINE CO.,** (Missouri-Kansas-Texas Railroad), New York.
Project: 2,300-mile LPG system from West Texas-New Mexico area to upper Midwest. Size of pipe 8 and 10-in., with branches 4 to 8-in.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa, is turnkey contractor. Subcontract for 4 to 8-in. line from Artesia, N. M., to Midkiff, Tex., awarded to McVean & Barlow, Odessa, Tex.
Completion: December 1960.

**NEW HAVEN PIPELINE, INC.,** 515 Madison Ave., New York 22, N. Y.
Project: 12-in. line from New Haven to Hartford, Conn., and 10-in. from there to Springfield, Mass., with a 6-in. spur to Westover Air Base at Ludlow, Mass.
Status: Proposed.

**SIBON PIPE LINE CO.,** Houston.
★ Project: Mississippi River crossing consisting of three 6-in. products lines near White Castle, La.
Status: Under way.
Contractor: Houston Contracting Co.

**SOHIO PIPE LINE CO.,** Guildhall Building, Cleveland 15, Ohio.
★ Project: 3 miles of 6-in. from the Dayton terminal to Wright-Patterson Air Force Base.
Completion: November 15, 1960.

**TEXAS EASTERN TRANSMISSION CORP.,** Box 1189, Houston. (Jointly with Buckeye Pipe Line Co.)
Project: 90-mile extension of Little Big Inch from Lebanon to Lima, Ohio.
Status: Under way.
Contractor: Shamrock Construction Co., Lansing, Mich.
Completion: November 15, 1960.
Project: 10 miles of 10-in. from Baytown to Mont Belvieu, Tex.
Completion: November 1960.

**WEST SHORE PIPELINE CO.** (Stock owned by Pure Oil Co. and Interstate Oil Pipe Line Co., a subsidiary of Standard Oil Co. of New Jersey).
★ Project: 200-mile line from Chicago to Milwaukee and Green Bay, Wis., with main line possibly 16-in. and laterals 12-in.
Status: Proposed. The line has backing of 10 oil companies.

**YELLOWSTONE PIPE LINE CO.,** Drawer 1267, Ponca City, Okla.
Project: 82 miles of 6-in. from Helena to Great Falls, Mont.
Status: Under way.
Contractor: R. H. Fulton & Co., Lubbock, Tex.
Completion: November 25, 1960.

## U. S. Natural Gas Pipelines

**ALASKA PIPE LINE CO.,** Houston, Tex.
Project: 82 miles from Kenai Unit gas field to Anchorage.
Status: Under way.
Contractors: Williams Brothers Co., Tulsa, has contract for 74 land miles, and Sharman, Allen, Gay & Taylor, Inc., Houston, has an 8½-mile water crossing.
Completion: By October 15, 1960.
★ Project: Extension of Kenai-Anchorage line to Fairbanks.
Status: Alaska Pipe Line Co. has ordered economic and engineering studies to determine feasibility of such a proposal.

**ALGONQUIN GAS TRANSMISSION CO.,** 25 Faneuil Hall Square, Boston 9, Mass.
Project: 30 miles of line in Massachusetts.
Status: Approved by FPC.

**ARKANSAS INDUSTRIAL PIPELINE CORP.** (Arkansas Louisiana Gas Co.), Shreveport.
Project: 130 miles of 18-in. from Perla to Helena, Ark.
Contractor: Pentzien, Inc., Omaha, has contract for dual crossing on the Arkansas River near Wright.
Completion: Fall 1960.

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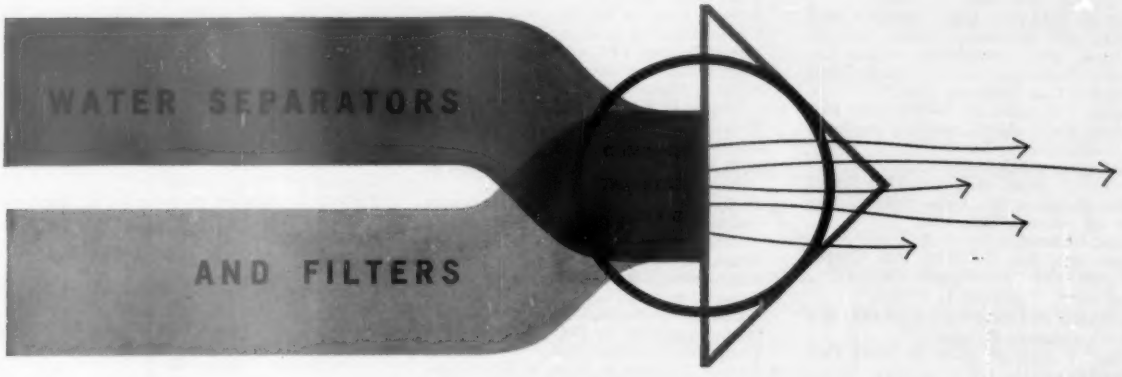


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## PIPELINE CONSTRUCTION

**ARKANSAS LOUISIANA GAS CO.,** Shreveport.
Project: About 58 miles of 2, 3, 4, and 6-in. line in various locations.
Completion: 1960.

**ARKANSAS WESTERN GAS CO.,** Box 405, Fayetteville, Ark.
★ Project: New lines from Altus, Coal Hill, and Rock Creek fields to the main system.
Status: Approved by Arkansas Public Service Commission.

**ATLANTIC SEABOARD CORP.,** Box 1273, Charleston 25, W. Va.
★ Project: 13½ miles of 22-in. from Strausburg to Ninevah, Va.
Status: Approved by FPC examiner.
Contractor: J. P. Neill & Co., Inc., Dallas.

**BORDER GAS TRANSMISSION CORP.** (owned by Lehman Brothers, New York investment firm, and Rio Gas Gathering Co., 615 National Bank of Commerce Building, San Antonio 5, Tex.).
Project: Gathering lines in Starr, Zapata, Jim Hogg, Brooks, and Webb counties, Texas.
Status: Proposed.
Project: Gathering lines in Dimmit, Zavala, and La Salle counties, Texas.
Status: Proposed.

**CENTRAL ILLINOIS LIGHT CO.,** 300 Liberty St., Peoria 2, Ill.
Project: About 53 miles of 24 and 30-in. line in Peoria, Tazewell, and Marshall counties, Illinois.
Status: Under way.
Contractor: Somerville-Illinois Co., Peoria, Ill.

**CENTRAL ILLINOIS PUBLIC SERVICE CO.,** 607 East Adams St., Springfield, Ill.
Project: 20 miles of 10-in. from the Tuscola area to the Mattoon and Charleston areas.
Completion: Fall 1960.

**CITIES SERVICE GAS CO.,** Box 1995, Oklahoma City 1, Okla.
Project: 13 miles of 16-in. from Alden field, Rice County, Kansas, to the company's Lyons station.
Contractor: Brodie Construction Co., Amarillo, Tex.
Completion: November 1, 1960.

**COASTAL STATES GAS PRODUCING CO.,** 200 Petroleum Tower, Corpus Christi, Tex. (Subsidiaries include Lo-Vaca Gathering Co. and South Texas Natural Gas Gathering Co.).
Project: 330 miles of various size pipe from Three Rivers area to southeast Lavaca County, Texas.
Completion: April 1, 1961.
Project: 27 miles of 8 and 33 miles of 6-in. from southeast La Salle County to the Pearsall, Tex., area.
Status: Under way.
Contractors: Jess Edwards, Inc., Corpus Christi, and Adair Pipeline Co.
Completion: December 1, 1960.

**COLORADO INTERSTATE GAS CO.,** Box 1087, Colorado Springs.
Project: 7 miles of 20-in. in Texas Panhandle.
Status: Pending FPC approval.
Completion: 1960.
Project: 109 miles of 26-in. from Texas Panhandle to southeastern Colorado; 134 miles of 34-in. from there to Pueblo, and 107 miles of 30-in. on to Denver; 155 miles of 34-in. from Green River, Wyo., to Provo, Utah.
Status: Approved by FPC examiner.
Completion: 1960.
Project: 32 miles of 6-in. from Central Colorado to Trinidad.
Status: Pending FPC approval.
Completion: 1960.

**COLORADO OIL & GAS CORP.,** Denver.
Project: 402-mile line from Gubik field to Fairbanks, Alaska.
Status: Proposed.

**COLUMBIA GULF TRANSMISSION CO.,** Box 683, Houston, Tex.
Project: 6 miles of 24 and 30-in. at Mississippi River crossing near Providence, La.
Status: Under way.
Completion: November 15, 1960.

**EL PASO NATURAL GAS CO.,** Box 1492, El Paso, Tex.
★ Project: 119 miles of 30-in. Permian-San Juan crossover loop.
Status: Pending FPC approval.
Completion: 1961.
★ Project: 13 miles of 20-in. loop on the Goldsmith-Plains line.
Status: Pending FPC approval.
Completion: Not known.
Project 51 miles of 20-in. from Terrell to Puckett, Tex.
Status: Temporarily approved by FPC.
Contractor: Western Pipe Line Construction Co.
Completion: Fall 1960.
Project: 17 miles of 30-in. near Spokane, Wash.
Status: Pending FPC approval.
Completion: Not known.
Project: 17 miles of 8-in. in the Klamath Falls, Ore., area.
Status: Pending FPC approval.
Completion: Fall 1960.
Project: About 121 miles of 10 to 20-in. line from mainline in Oregon to Portland and Eugene.
Status: Temporarily approved by FPC.
Contractor: Hood-Rivers Associates.
Completion: Fall 1960.
Project: Permian-San Juan crossover loop, involving 119 miles of 30-in.
Status: Pending FPC approval.
Completion: 1961.
Project: 34 miles of 20-in. from Puckett tie-in to Goldsmith, Tex.
Status: Pending FPC approval.
Completion: 1961.
Project: 23 miles of 20-in. from Goldsmith to the Eunice-Plains line, and 395 miles of 34-in. from Thistle, Utah, to near Las Vegas, Nev.
Status: Pending FPC approval.
Completion: 1961.
Project: Loop on the San Juan mainline, involving 27½ miles of 34-in.
Status: Pending FPC approval.
Completion: Not known.
Project: About 228 miles of 30-in. from Coquat to Sonora, Tex.
Status: Pending FPC approval.
Completion: Not known.

**EQUITABLE GAS CO.,** 420 Boulevard of the Allies, Pittsburgh, Pa.
★ Project: 15 miles of 16-in. in Monongalia County, West Virginia, and Greene County, Pennsylvania.
Status: Approved by FPC.
Completion: October 1961.
★ Project: 6 miles of 20-in. in Greene County, Pennsylvania.
Status: Approved by FPC.
Completion: October 1961.
★ Project: 17 miles of 20-in. in Greene and Washington counties, Pennsylvania.
Status: Approved by FPC.
Completion: October 1962.
Project: 4 miles of 20-in. in Greene County, Pennsylvania.
Status: Approved by FPC.
Contractor: Joyce Pipeline Co., Andover, N. Y.
Completion: October 1960.
Project: 17 miles of 16-in. in Marion and Monangalia counties, West Virginia.
Status: Approved by FPC.
Contractor: Joyce Pipeline Co., Andover, N. Y.
Completion: October 1960.

**HOUSTON TEXAS GAS & OIL CORP.,** Box 10400, St. Petersburg 33, Fla.
Project: 235 miles of 2 to 6-in. lateral lines.
Status: Pending FPC approval.
Completion: January 1, 1961.

**IOWA-ILLINOIS GAS & ELECTRIC CO.,** 206 East 2 St., Davenport, Iowa.
Project: 25 miles of 4 and 6-in. line north of Muscatine, Iowa.
Status: Under way.
Contractor: Midwestern Contractors, Inc., Wheaton, Ill.

**IRON RANGES NATURAL GAS CO.,** St. Paul.
Project: 79 miles of 10 and 12-in. from Grand Rapids to Hoyt Lake, Minn., and 67 miles of 12-in. from Duluth to Silver Bay, Minn.
Status: Approved by FPC.
Completion: 1960.

**LO-VACA GATHERING CO.** (see parent company, Coastal States Gas Producing Co.)

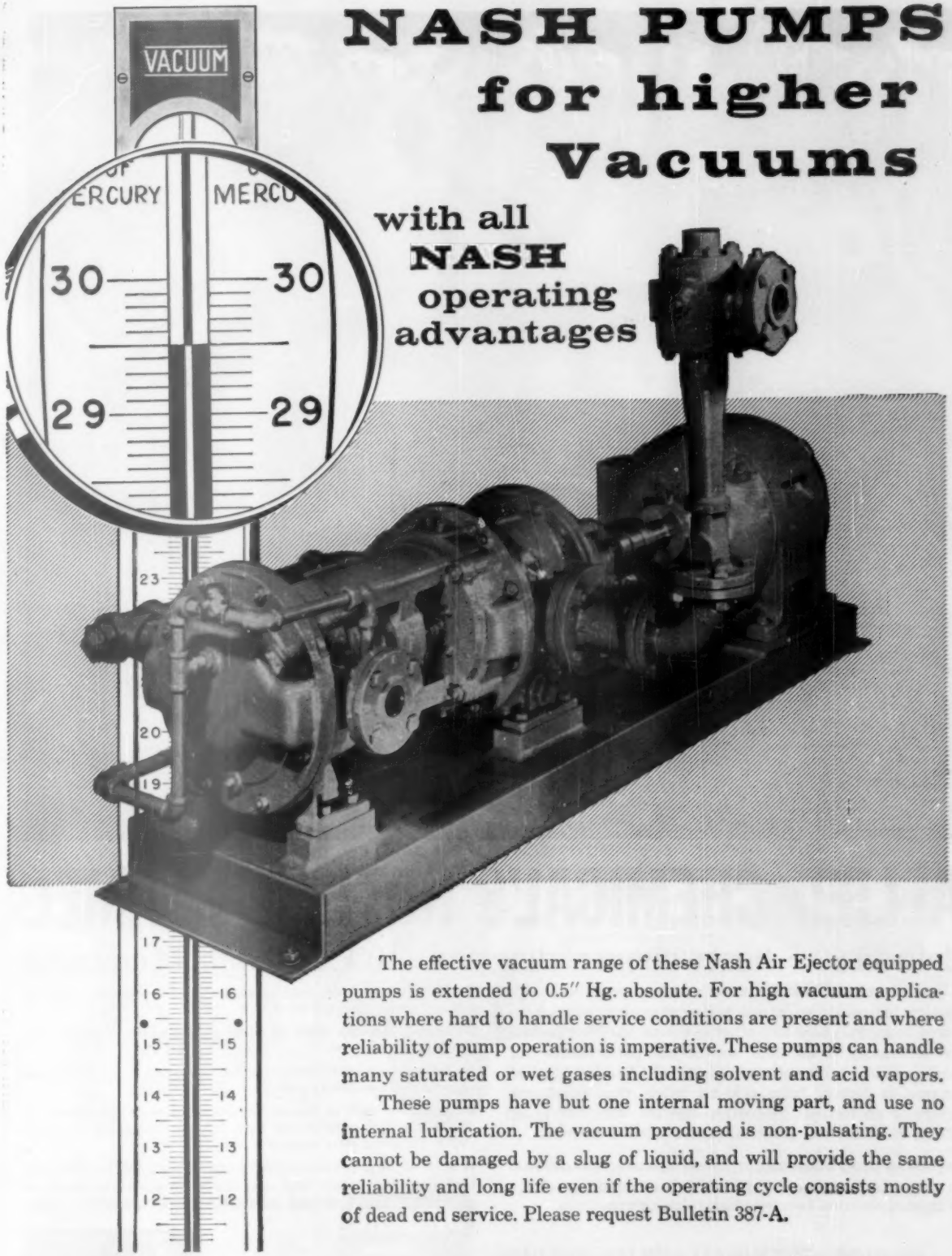
**MICHIGAN CONSOLIDATED GAS CO.,** 415 Clifford St., Detroit 26, Mich.
Project: 47 miles of 30-in. from Elsie to Sixlakes, Mich.
Status: Under way.
Contractor: Williams Brothers Co., Tulsa.

**MICHIGAN WISCONSIN PIPE LINE CO.,** 500 Griswold Street, Detroit 26, Mich.
★ Project: 26 miles of 6 and 8-in. in Wisconsin.
Status: Approved by FPC.
★ Project: 15 miles of 4-in. in Michigan.
Status: Approved by FPC.
Projects: 342 miles of 24-in. and 191 miles of 30-in. in Kansas, Iowa, Illinois, Michigan, and Indiana.
Status: Approved by FPC.
Contractors: R. H. Fulton & Co., Lubbock, Tex.; Bechtel Corp., San Francisco; Majestic Contractors, Inc., Houston; and Somerville Construction Co., Ada, Mich.
Completion: November 1960.
Project: 92 miles of 20 and 24-in. from Appleton to Marshfield. Wis.
Status: Under way.
Contractor: Houston Contracting Co.
Completion: November 1960.
Projects: 86 miles of 16-in. and 38 miles of 4-in. in Wisconsin.
Status: Approved by FPC.
Contractor: Harbert Construction Corp., Birmingham, Ala.
Completion: November 1960.
Project: 111 miles of 4, 6, and 8-in. in Wisconsin.
Status: Approved by FPC.
Contractor: Panama-Williams Corp., Houston.
Completion: November 1960.
Project: 31 miles of 4 and 6-in. in Wisconsin.
Status: Approved by FPC.
Contractor: R. H. Fulton & Co., Lubbock, Tex.
Completion: November 1960.
Project: 42 miles of 4 and 6-in. in Iowa.
Status: Approved by FPC.
Contractor: Vedal Pipe Line Construction Co., Mount Vernon, Ill.
Completion: November 1960.

**MIDWESTERN GAS TRANSMISSION CO.,** Houston.
Project: 504 miles of 24-in. from Emerson, Man., to Marshfield, Wis., plus 54 miles of sales laterals.
Status: Under way.
Contractors: Bechtel Corp., 155 miles from Canadian border to Becker-Clay county line in Minnesota; Grayco Constructors, Inc., 54 miles from Becker-Clay county line to near New York Mills, Minn.; H. G. Price Co., 56 miles from New York Mills to Mississippi

# NASH PUMPS for higher Vacuums

with all **NASH** operating advantages

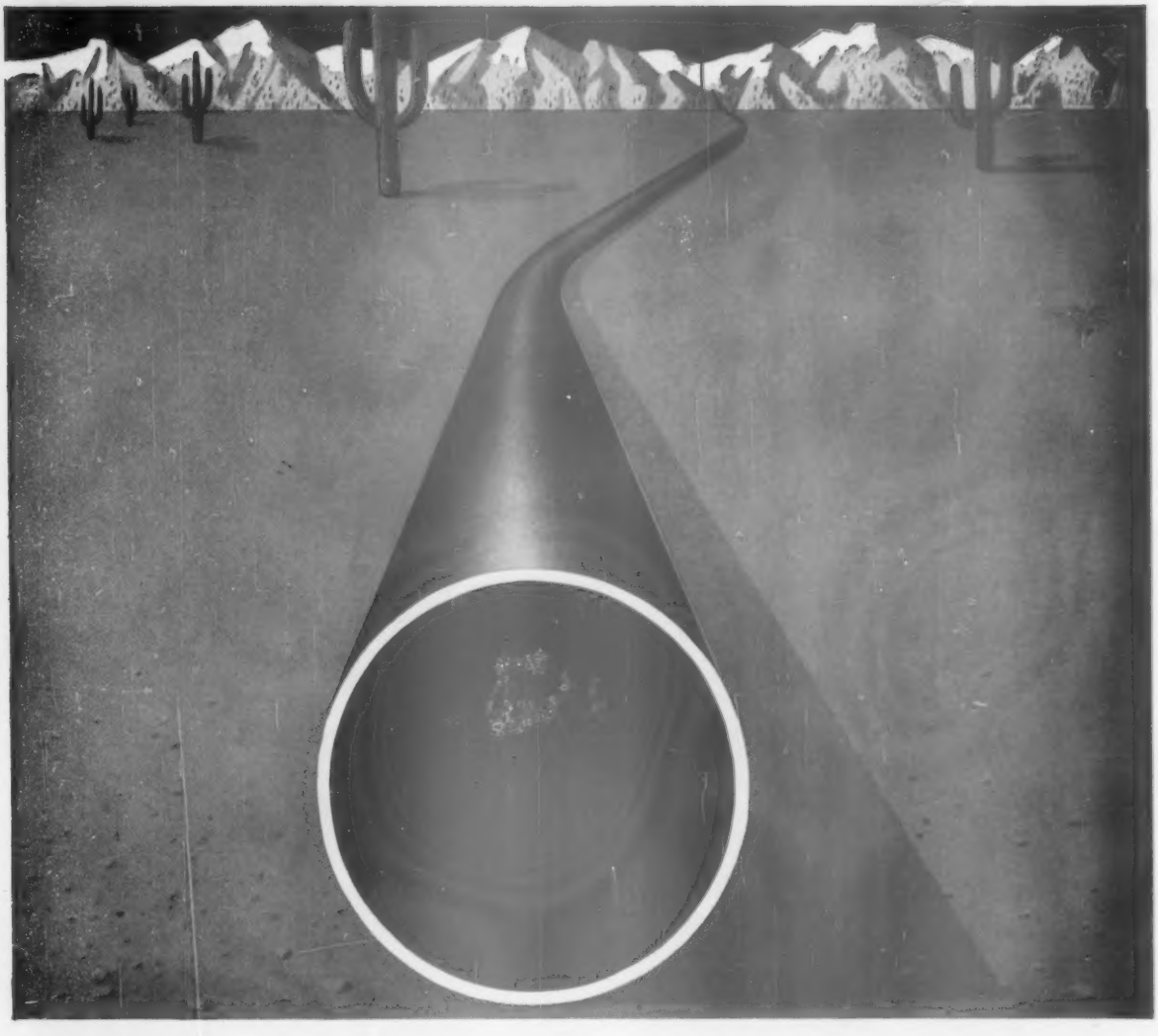



The effective vacuum range of these Nash Air Ejector equipped pumps is extended to 0.5″ Hg. absolute. For high vacuum applications where hard to handle service conditions are present and where reliability of pump operation is imperative. These pumps can handle many saturated or wet gases including solvent and acid vapors.

These pumps have but one internal moving part, and use no internal lubrication. The vacuum produced is non-pulsating. They cannot be damaged by a slug of liquid, and will provide the same reliability and long life even if the operating cycle consists mostly of dead end service. Please request Bulletin 387-A.

## NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.



# ALLIED CHEMICAL'S HOTLINE ENAMEL

## defies 180°F. heat without sliding and −10°F. cold without cracking

Allied Chemical Hotline Enamel's resistance to both high and low temperatures, as well as its greater durability, compared to asphalt base and other coatings, has been proved by laboratory tests, and on-the-job performance for leading public utility companies. Allied Chemical Hotline Enamel is derived from coal-tar pitch, thus possessing inherent protective properties against the damaging effects of water, soil chemicals and electrical currents.

**Improves protection under these specific conditions:**

1. On pipe-type cables or "oil-o-static lines" which are subject to internal electrical heat from high-voltage surges.
2. Hot gas pipelines, on discharge side of compressor stations where line is above 120°F.
3. Warm, swampy areas or other places where excessive soil stress is encountered.
4. Areas where backfill and trenches are rough, rocky or contain objects which normally penetrate softer coatings.
5. Pipelines (such as heated fuel lines) where temperatures are constantly high most of the time, but do not exceed 180°F. or 200°F. for short term exposure.

A staff of field service experts are at your call to offer you technical assistance that can save you maintenance time and costs. **LAST WORD IN CORROSION PROTECTION.**

**PLASTICS AND COAL CHEMICALS DIVISION**
40 Rector Street, New York 6, N. Y.

Allied Chemical

River; Houston Contracting Co., 109 miles from Mississippi River to Wanderoos, Wis.; Contracting & Material Co., 54 miles from Wanderoos to Chippewa River; Panama, Inc., 66 miles from Chippewa River to Marshfield, Wis.; Texas Pipeline Construction, Inc., 16 miles of laterals; and Bristow-Hyde Engineering Corp., 39 miles of laterals.
Completion: By November 1, 1960.

**MISSISSIPPI RIVER FUEL CORP.,** 407 North 8th Street, St. Louis 1, Mo.
Project: 5 miles of 16-in. and 15 miles of 12-in. from Collinsville, Ill., to St. Jacob, Ill.
Status: Pending FPC approval.

**MISSISSIPPI RIVER TRANSMISSION CORP.** (Mississippi River Fuel Corp.), St. Louis.
Project: 94 miles of 18-in. from Johnsonville, Ill., to the St. Louis area.
Status: Pending FPC approval.

**MOUNTAIN FUEL SUPPLY CO.,** 180 East 1st South Street, Salt Lake City.
Project: 20 miles of 20-in. from Piedmont to Yellow Creek.
Completion: October 9, 1960.

**MUSTANG FUEL CORP.,** affiliate of Oklahoma Resources Development Co., Cameron Building, Oklahoma City.
Project: About 170 miles of 12-in. trunk line from Oklahoma City to Harrah and Muskogee, Okla., and about 130 miles of 4 to 12-in. lateral in Central Oklahoma.
Contractors: Sadler Brothers Pipeline Construction Co. and Montin-Harbert Pipe Line Construction Co., both of Oklahoma City.
Completion: Fall 1960.

**NATURAL GAS GATHERING CO., INC.,** Corrigan Tower, Dallas, and **GULF RESOURCES, INC.**
Project: 31 miles of 10, 12, and 14-in. in Zapata and Starr counties, Texas.
Status: Approved by FPC.
Completion: October 30, 1960.

**NATURAL GAS PIPELINE CO. OF AMERICA,** 122 South Michigan Avenue, Chicago.
Project: 188 miles of 24 and 139 miles of 36-in. loops in Oklahoma, Kansas, and Iowa.
Status: Under way.
Contractors: River Construction Corp., Fort Worth, Tex.; O. R. Burden Construction Corp., Tulsa, Okla.; and R. H. Fulton & Co., Lubbock, Tex.
Completion: Fall 1960.
Project: 5 miles of 8-in. Chitwood lateral line in Grady County, Oklahoma.
Status: Pending FPC approval.
Project: 18 miles of 4 to 10-in. Smith-Collins gathering system in Carson County, Texas.
Status: Pending FPC approval.

**NORTHERN NATURAL GAS CO.,** Omaha.
Project: About 100 miles of 30-in. loop line and 14 miles of 24-in. between Beaver, Okla., and Minneapolis, Minn.
Status: Under way.
Contractor: Panama-Williams Corp., Houston.
Completion: October 27, 1960.
Project: About 530 miles of 2 to 16-in. branch lines to connect 58 new communities.
Status: Under way.
Contractors: Prairie Construction Co., Lubbock, Tex.; R. E. Reutzel Co., Freemont, Neb.; Underground Constructors, Dodge Center, Minn.; C. S. LeNoir Construction Co., Austin, Tex.; and Pipeline Welding Co., Tulsa, Okla.
Project: 41 miles of varying diameter gathering lines in Ochiltree and Hans-

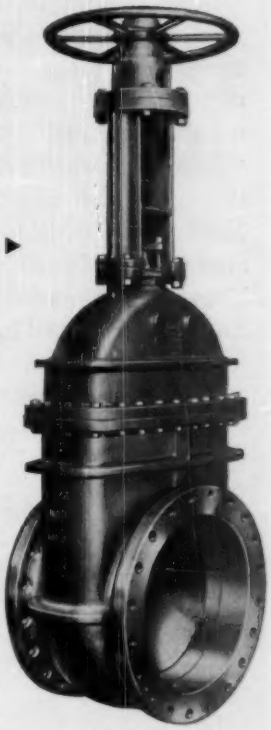

Check this DARLING gate valve trio for

UNMATCHED ADVANTAGES

in every oil, gas and petrochemical service

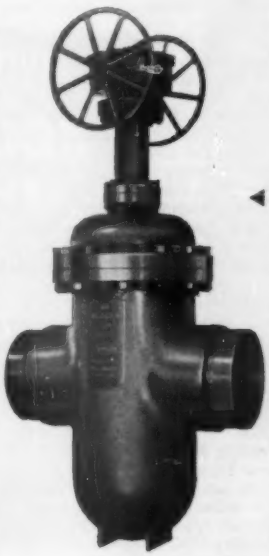
◀ **DARLING FULLY REVOLVING DOUBLE DISC GATE VALVES**

—famous for *consistently* trouble-free operation in all kinds of service. Revolving disc principle assures easy operation, surer closure, minimum friction, automatic seating compensation, extreme life with minimum maintenance. Ask for Catalog 57.



**DARLING ALUMINUM ALLOY GATE VALVES** ▶

—featuring all the advantages of the above revolving disc principle, *plus* new economies in the handling of "problem" fluids and gases or wherever aluminum piping is used. Ask for Bulletin SLS 5801.



◀ **DARLING-McEVOY SELF-SEALING CONDUIT VALVES**

— the *only* conduit gate valve with *sealant gasketing* between gates and seats. Every closure leakproof! This and other advantages proved by outstanding performance on major lines. Get *all* the facts. Ask for Catalog 57.

Whatever the service, in any phase of pipelining, gathering or processing, these Darling gate valves offer worthwhile features and advantages unobtainable in other valves. The catalogs referred to above are available to give you the pertinent facts.

DARLING VALVES

**DARLING VALVE & MANUFACTURING CO.**
Williamsport 1, Pa.
*Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario*

# New ELDER "Knock-Down" Field Housing Units

## Save up to 80% on shipping costs!

**Shipping costs drop,** handling speeds up with Elder's "Knock-Down" units. Now you can ship field housing overseas or move complete camps to new locations at one-fifth the cost!

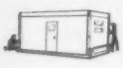
"Knock-Down" units are quickly erected with a minimum of labor. Side walls, mounted on continuous hinges, simply raise into place. End walls are bolted into side walls and frame. Fiberglass roof is one-piece construction.

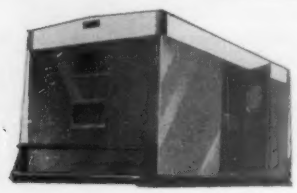
*Elder designs and builds all types of mobile housing for field crews.*

*Knock-down unit ready for setting up.*

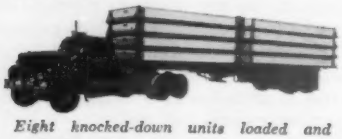
*Side walls go up first.*

*End walls and roof are locked securely into place.*





*Unit erected.*



*Eight knocked-down units loaded and ready for shipment.*

**ELDER TRAILER AND BODY, INC.**

DENVER PLANT: 4830 Race Street, Phone AMherst 6-1781

HOUSTON PLANT: 4510 Navigation Blvd. Phone WAlnut 6-8335


## PIPELINE CONSTRUCTION

ford counties, Texas.
Status: Approved by FPC.
Project: About 21 miles of 16-in. and 26 miles of various small diameter pipeline in the Glick field, Kansas, area.
Status: Pending FPC approval.
Project: 188 miles of 24-in. and 215 miles of 30-in. from Farmington, Minn., to International border.
Status: Proposed.
Project: 83 miles of 20-in. from East Dubuque, Ill., to Janesville, Wis.
Status: Pending FPC.
Completion: Fall 1960.

**OLD OCEAN FUEL CO.** (subsidiary of Texas Electric Service Co.). Fort Worth.
Project: 364 miles of 12, 16, 20, and 24-in. from Gulf Coast south of Houston to the Fort Worth area.
Status: Under way.
Contractors: H. B. Zachry Co., San Antonio, Tex., and O. R. Burden Construction Corp., Tulsa, Okla.
Completion: December 1960.

**PACIFIC GAS & ELECTRIC CO.,** San Francisco.
Project: 9 miles of 12-in. from Berenda Creek to Chowchilla, Calif.
Contractor: Company crews.
Completion: 1960.
Project: 8 miles of 16 and 2 miles of 10-in. Fresno reinforcement.
Contractor: Company crews.
Completion: 1960.
Project: 7 miles of 16-in. from Ignacio to Petaluma, Calif.
Contractor: Company crews.
Completion: 1960.
Project: 67 miles of line from Kettleman Hills to Morro Bay, Calif.
Project: 120 miles of 34-in. looping of Topock-Milpitas main line.
Status: Planned. Pending FPC approval.
Completion: 1961.
Project: 11 miles of 20-in. from Pittsburg to Walnut Creek, Calif.
Contractor: Using company crews.
Completion: 1960.
Project: 296 miles of 36-in. from the California-Oregon border to Antioch, Calif.
Status: To start fall 1960.
Completion: 90 miles scheduled for completion in 1960, the rest in 1961.

**PACIFIC GAS TRANSMISSION CO.** (Pacific Gas & Electric, San Francisco).
Project: 614 miles of 36-in. from Kingsgate, B. C., to California border near Klammath Falls, Ore.
Status: Under way.
Completion: By 1961-62 heating season.

**PANHANDLE EASTERN PIPE LINE CO.,** 1221 Baltimore Avenue, Kansas City, Mo.
Project: 50 miles of 22-in. and 150 miles of 24-in. from Haven, Kans., to Elk City, Okla.
Status: Pending FPC approval.
Completion: December 31, 1960.
Project: 300 miles of 30-in., 18 miles of 26-in., 9 miles of 12-in., 29 miles of 8-in., and 40 miles of 6-in. loop.
Status: Pending FPC approval.
Completion: December 31, 1960.
Project: 141 miles of 4 to 16-in. gathering line.
Contractor: Hall Construction Co., Liberal, Kans.
Completion: December 31, 1960.

**PEOPLES GAS LIGHT & COKE CO.,** 122 South Michigan Avenue, Chicago 3, Ill.
Project: 29 miles of 36-in. in the Chicago area.
Status: One portion under way.
Completion: 1960-62.

**PEOPLES GULF COAST NATURAL GAS PIPELINE CO.,** 122 South Michigan Avenue, Chicago 3, Ill.
Project: 371 miles of 30-in. loop of present system between Texas and Chicago.
Status: Under way.
Contractors: Stanley-Bledsoe Corp.; O. R. Burden, Tulsa, Okla.; H. C. Price Co., Bartlesville, Okla.; River Construction Corp., Fort Worth, Tex.; Panama-Williams Corp., Houston; and Sharman, Allen, Gay & Taylor, Inc., Houston.
Completion: November 15, 1960.
Project: About 59 miles of various size looping of main line in Texas.
Completion: October 12, 1960.

**PEOPLES NATURAL GAS CO.,** Two Gateway Center, Pittsburgh 22, Pa.
★ Project: 2½ miles of 12-in. near Wall station, Pennsylvania.
Status: Under study.
★ Projects: 10 miles of 12 and 20-in. in Pennsylvania.
Status: Preliminary work and right-of-way acquisition in progress.
Completion: November 30, 1960.
★ Project: 5 miles of 12-in. south of Girty station. Pennsylvania.
Status: Acquiring right-of-way.
Contractor: Joyce Western Corp.
Completion: November 1, 1960.
Project: 4 miles of 12-in. from Mount Royal to King Farm, Pa.
Status: Under way.
Contractor: Laurel Ridge Construction Co.
Completion: October 15, 1960.

**PIONEER NATURAL GAS CO.,** Amarillo.
Project: 21 miles of 12-in. from Sudan to Muleshoe, Tex.
Status: Pending FPC approval.
Project: 12 miles of 10-in. from Muleshoe, Tex. northward.
Status: Pending FPC approval.

**PUBLIC SERVICE CO. OF NORTH CAROLINA,** Gastonia, N. C.
Project: About 47 miles of 4, 8, and 10-in. in North Carolina.


S. E. HUEY & CO.

ENGINEERS & SURVEYORS

OUACHITA BANK BLDG.

MONROE, LA.

SURVEYING & MAPPING

PIPE LINE SURVEYS

# PIGS FOR ANY PURPOSE

Cleaning, batching, gauging, displacement

## IN ANY LINE

Crude oil, products, natural gas, water, chemical

## OF ANY SIZE

From 2″ to worlds largest (55″). Standard sizes 2″ to 36″

LOOK TO WmSON . . . PIONEERS IN PIPELINE PIGGING

**T.D. Williamson, Inc.**

P. O. BOX 43 TULSA 2, OKLAHOMA

REPRESENTATIVES AROUND THE WORLD

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PRIME and COMPETITIVE

# Anti-Corrosion PIPELINE MATERIALS

- Asbestos felt and Rockshield
- Glass Pipeline Wraps
  Mfd. by Owens-Corning Fiberglas Corporation
- Tapes
- Kraft Wraps
- Casing Seals
  Mfd. by Irish Pipe Line Supply Co.
- Alpon Internal Pipe Coating
  (Epoxy Coating)
- Tar Clad
  (Coal Tar Epoxy Coating)

GOOD SERVICE . . . . . SPECIFICATION MATERIALS

**Perrault Supply Co.**

DIVISION OF ALLIED PAINT MFG. CO.
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Gibson 7-0101
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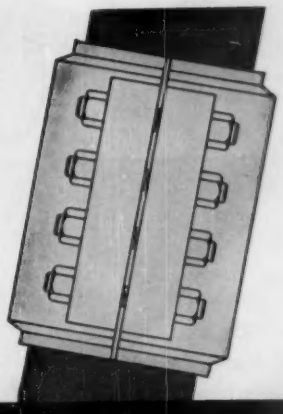
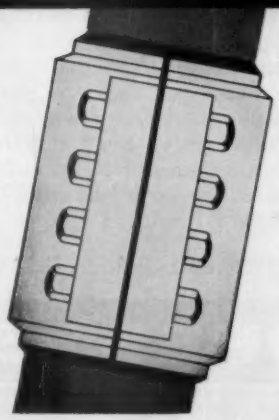


Completed Installation

# FAST, SAFE PIPELINE REPAIRS WITH NEW SMITH SPLIT-COUPLING

The Smith Split-Coupling can be used as coupling, repair clamp or split sleeve.

Easy installation—Place halves around pipe. Tighten side bolts. **Permits welding while pumping.** Available in standard pipe sizes. Extra lengths and special dimensions on application.

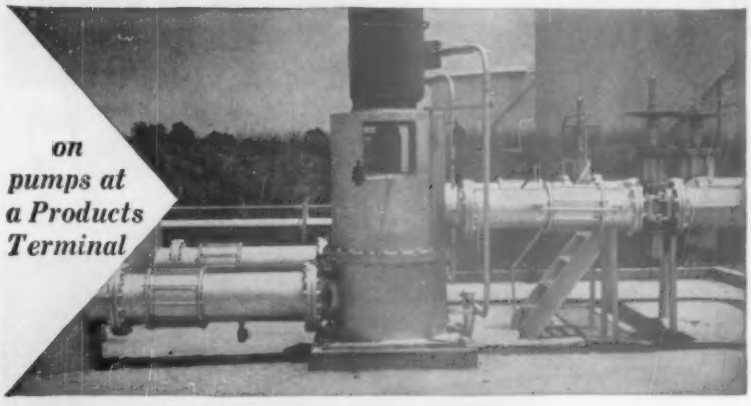


Completed Installation (When welding is specified)

**THE PIPE LINE DEVELOPMENT COMPANY**

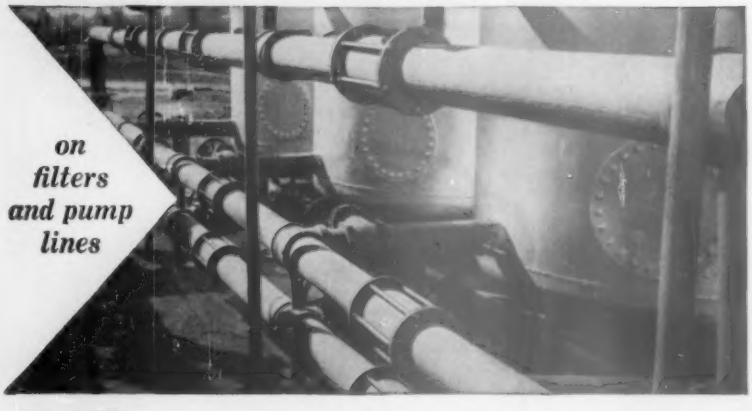
5700 Detroit Avenue
Cleveland 2, Ohio

*Dresser® Couplings—*



*on pumps at a Products Terminal*

**easy, bottle-tight...**



*on filters and pump lines*

**safe, permanent joints!**

Dresser Couplings are easily installed and bottle-tight for life! The specially compounded Dresser Gasket provides rugged "give and take" to absorb vibration, settlement and other stresses that might cause damage. And there's no pipe threading. With plain end pipe, any workman can install Dresser Couplings in an average two man-minutes per bolt *using only a wrench.* And even with pipe deflection up to 4°, you still get a perfect Dresser-Coupled joint. Send for Dresser Catalog No. 531; it contains more detailed information and complete specifications on *all* Dresser Couplings, Fittings and Pipe Repair Products.

• GET THEM FROM YOUR LOCAL OIL FIELD SUPPLY STORE

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DRESSER
MANUFACTURING DIVISION

ONE OF THE DRESSER INDUSTRIES


## PIPELINE CONSTRUCTION

**RIO GRANDE VALLEY GAS CO.,** Box 391, Brownsville, Tex.
Project: 60 miles of 12-in. in Hidalgo, Starr, and Jim Hogg counties from Moore field area to Prado field area, replacing and reconditioning existing line.
Status: Planned.
Completion: 1961.
Project: 5 miles of 6-in. from Moore field area to North Monte Christe field, Hidalgo County.
Contractor: Own forces.
Completion: December 1960.
Project: 3½ miles of 12-in. in South Weslaco field area, Hidalgo County.
Contractor: Own forces.
Completion: December 1960.

**ROCKY MOUNTAIN NATURAL GAS CO.**
Project: 65 miles of gas line in southwestern Colorado to supply Collbran, Montrose, Delta, and Orchard City.
Status: Under way.
Contractor: H. C. Price Co., Bartlesville, Okla.
Completion: Fall 1960.

**SAN DIEGO GAS & ELECTRIC CO.,** Box 1831, San Diego 12, Calif.
★ Project: 51 miles of 30-in. from the Rainbow meter station to San Diego.
Status: Under way.
Contractor: Stanley-Bledsoe Corp.

**SOUTHERN CALIFORNIA GAS CO.,** Los Angeles.
Project: 13 miles of 34-in. from San Fernando Valley to West Los Angeles.
Status: Approved.
Completion: 1960.

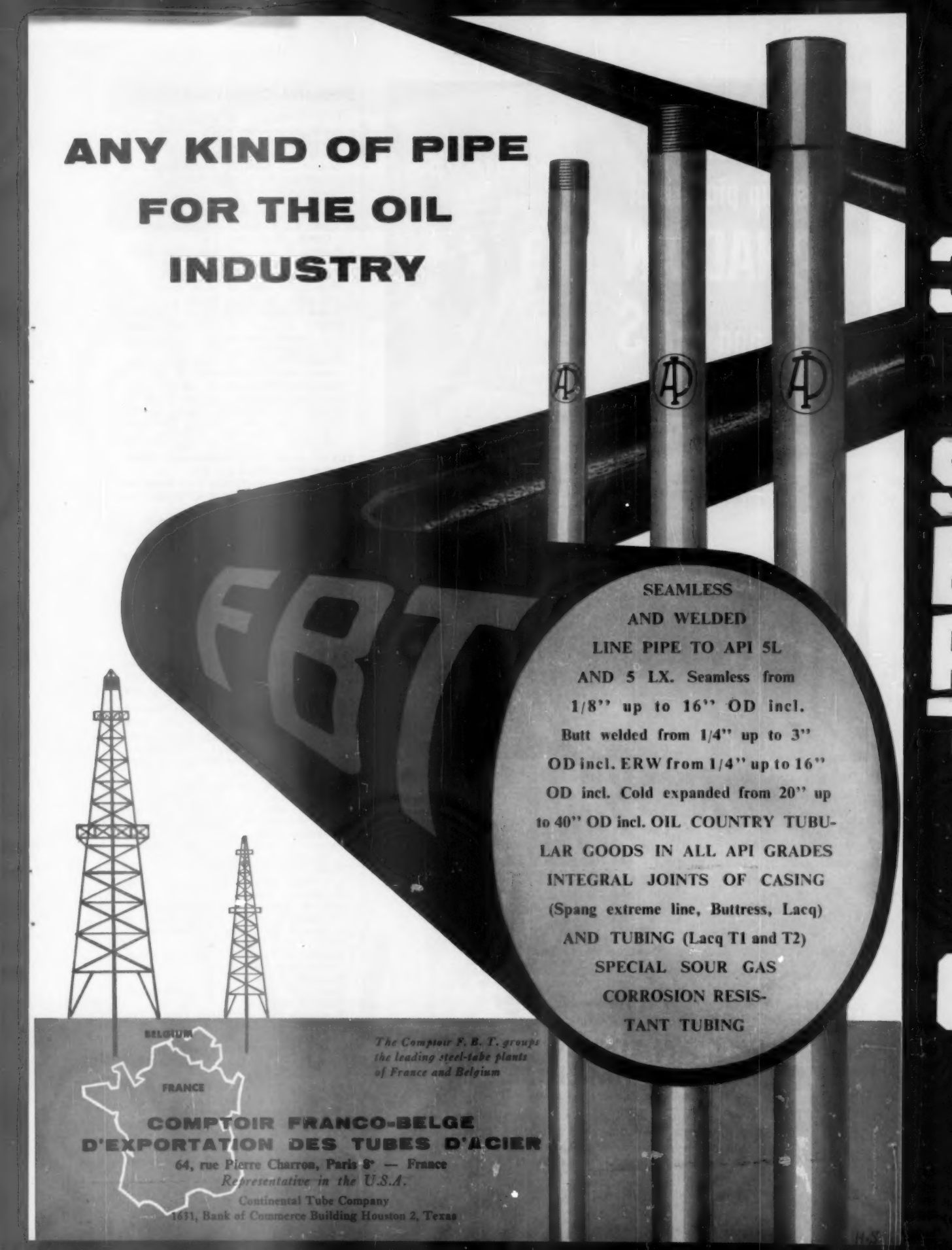
**SOUTHERN CALIFORNIA GAS CO.,** and **SOUTHERN COUNTIES GAS CO. OF CALIFORNIA,** Los Angeles.
Project: 150-mile line across southern California from the Nevada border to the Los Angeles basin. Line would connect with a proposed El Paso Natural Gas Co. line extending to Rock Springs, Wyo.
Status: Pending approval of State Public Utilities Commission of California.

**SOUTHERN NATURAL GAS CO.,** Watts Building, Birmingham, Ala.
★ Projects: 7 miles of 10-in. from Hub field to Dexter field, Mississippi. and 11 miles of 8-in. supply line loop at nearby Sandy Hook field.
Contractor: Harbert Construction Corp., Birmingham.
Completion: November 1, 1960.

**ST. LAWRENCE GAS CO.,** Ogdensburg, N. Y.
Project: 75 miles of line from Cornwall, Ont., to Ogdensburg, N. Y.
Status: Approved by FPC.

**TENNESSEE GAS PIPELINE CO.,** a division of Tennessee Gas Transmission Co., Box 2511, Houston 1, Tex.
Project: 21 miles of 16-in. gathering line from Louisiana coast to Block 46 in the Vermilion area.
Status: Pending FPC approval.
Project: 2 miles of 12-in. gathering line from Block 66 to Block 64, East Cameron area, offshore Louisiana.
Status: Pending FPC approval.
Project: 158 miles of 36-in. loop lines at various points between Kinder, La., and Centerville, Tenn.
Status: Approved by FPC.
Project: 11½ miles of 16-in., 44 miles of 12-in., and 10 miles of 10-in. off Louisiana coast.
Status: Pending FPC approval.
Project: 12 miles of 12-in. gathering line from Louisiana coast to Block 17, East Cameron area, offshore Louisiana.
Status: Approved by FPC.

# ANY KIND OF PIPE FOR THE OIL INDUSTRY



SEAMLESS AND WELDED LINE PIPE TO API 5L AND 5 LX. Seamless from 1/8" up to 16" OD incl. Butt welded from 1/4" up to 3" OD incl. ERW from 1/4" up to 16" OD incl. Cold expanded from 20" up to 40" OD incl. OIL COUNTRY TUBULAR GOODS IN ALL API GRADES INTEGRAL JOINTS OF CASING (Spang extreme line, Buttress, Lacq) AND TUBING (Lacq T1 and T2) SPECIAL SOUR GAS CORROSION RESISTANT TUBING




*The Comptoir F. B. T. groups the leading steel-tube plants of France and Belgium*

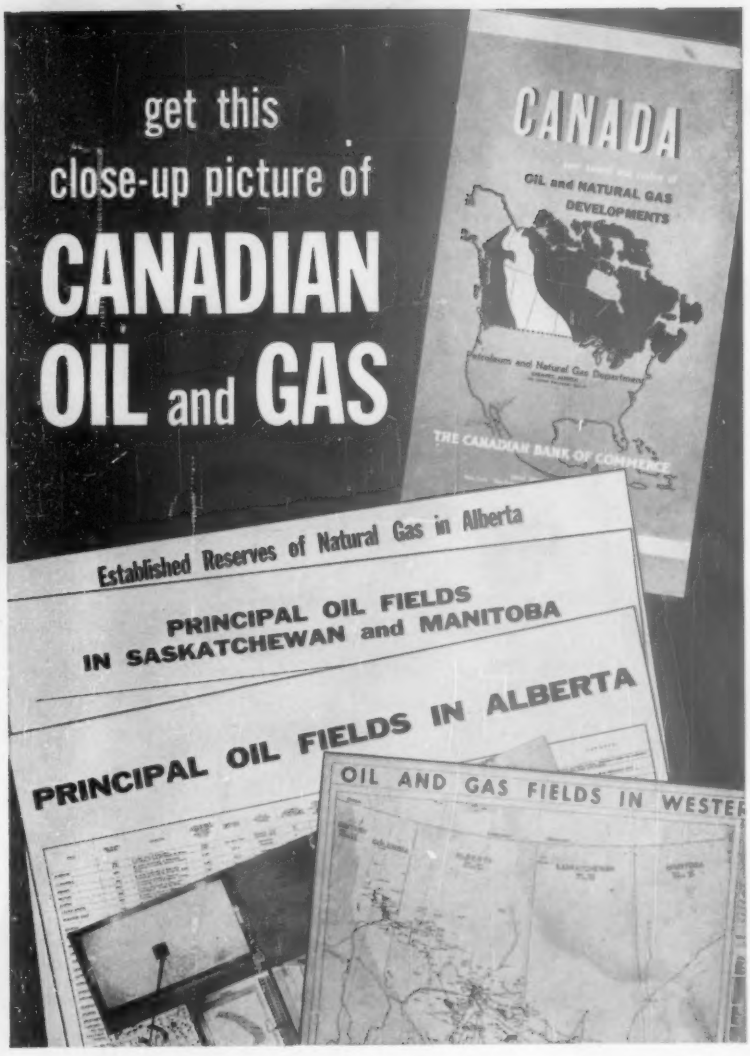
**COMPTOIR FRANCO-BELGE D'EXPORTATION DES TUBES D'ACIER**

64, rue Pierre Charron, Paris 8e — France

*Representative in the U.S.A.*

Continental Tube Company

1631, Bank of Commerce Building Houston 2, Texas




With a Petroleum and Natural Gas Department in Calgary staffed with technical men, and with nearly 300 of our branches located in Western Canada and the Northwest and Yukon Territories, we are in continuous touch with Canada's oil and gas developments. For information on any phase of the Canadian petroleum industry, please send your letterhead request for our complete and up-to-date review of developments. It contains our latest map, statistical data on the principal Canadian oil and gas fields, and a summary of the special services we offer to the industry.

Address your inquiry either to

Petroleum and Natural Gas Department
The Canadian Bank of Commerce
309 Eighth Avenue West
Calgary, Alberta, Canada

*or to*

Mr. John P. Moreton
Resident Representative
The Canadian Bank of Commerce
1512 Commerce Street, Dallas, Texas

*We do not advise regarding speculative securities.*

*In Canada, it's—*

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More than 850 branches across Canada


## PIPELINE CONSTRUCTION

Project: 166 miles of 36 and 30-in. loop lines at various points in Ohio and Pennsylvania.
Status: Pending FPC approval.
Project: 25 miles of 30-in. loop from Hamburg, N. Y., eastward.
Status: Under way.
Contractor: J. P. Neill & Co., Inc., Dallas.
Completion: Fall 1960.

**TEXAS EASTERN TRANSMISSION CORP.,** Shreveport, La.
Project: 85 miles of 24-in. from Tamarack, to Perulack, Pa.
Status: Approved by FPC.
Project: 40 miles of 36-in. from Lambertville, to Linden, N. J.
Status: Approved by FPC.
Project: 23 miles of 20-in. from Eagle, to Chester Junction, Pa.
Status: Approved by FPC.
Project: 53 miles of 30-in. from Perulack, Pa., to Lambertville, N. J.
Contractors: Contracts for the above Texas Eastern projects are held by H. C. Price Co., Bartlesville, Okla.; Western Pipe Line, Inc., Austin, Tex.; and Sharman, Allen, Gay & Taylor, Inc., Houston. Completion in 1960.

**TEXAS GAS TRANSMISSION CORP.,** Box 577, Owensboro, Ky.
Project: 29 miles of 12-in. from Slaughters to proposed storage at Greenville, Ky.
Status: Approved by FPC.
Project: 24 miles of 30-in. south of Bastrop, La., and 56 miles of 12-in. loop in Indiana.
Contractor: Western Pipe Line, Inc., Austin, Tex., has contract for the 12-in. in Indiana.
Completion: Fall 1960.
Project: 17 miles of 10-in. from its existing 20-in. line near Thibodaux, La., to a proposed meter station in Bayou Chevreuil field.
Status: Approved by FPC.

**TRANSCONTINENTAL GAS PIPE LINE CORP.,** 3100 Travis St., Houston, Tex.
Projects: 62 miles of 30-in. in Texas and 7 miles of 30-in. in Louisiana.
Status: Pending FPC approval.
Completion: 1961.
Projects: 23 miles of 36-in. in Louisiana, 39 miles in Mississippi, 88 in Alabama, 83 in Georgia, and 36 miles in South Carolina.
Status: Pending FPC approval.
Completion: 1961.
Project: 7 miles of 16-in. in New Jersey.
Status: Pending FPC approval.
Completion: 1961.
Project: 73 miles of 8 to 16-in. offshore Louisiana line.
Status: Under way.
Contractor: Brown & Root, Inc., Houston.
Completion: 1960.
Projects: 1-mile, 16-in. Delaware River crossing in New Jersey and 14 miles of 20-in. in New Jersey and Pennsylvania.
Status: Under way.
Contractor: Fulghum Contracting Corp., Harrisburg, Pa.
Completion: 1960.
Project: 10 miles of 6-in. in Mississippi.
Status: Under way.
Contractor: Sharman, Allen, Gay & Taylor. Inc., Houston.
Completion: 1960.

**TRANSWESTERN PIPELINE CO.,** 618 First City National Bank Building, Houston 2, Tex.
Project: 250 miles of gathering lines in West Texas and the Anadarko basin.
Status: Temporarily approved by FPC.

**TRUNKLINE GAS CO.,** Box 1642, Houston.
Projects: About 155 miles of 30-in. loop in Illinois, Kentucky, Tennessee, Missis-

NATIONAL AIROIL BURNER

# ENGINEERING NEWS

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You may wish to check certain items in this advertisement and forward to those concerned in your company.

ROUTE TO:

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## National Airoil offers IMPROVED Model CP Vertical Firing Combustion Units

Here's big news! Now available is the *improved* National Airoil Model CP Vertical Oil Firing Combustion Units, ideally suited for use with stills, heaters, super-heaters, vaporizers, air-heaters, and other process furnaces in refineries, oil producing fields, and chemical plants. The units are used extensively in vertical and horizontal tube heaters of either cylindrical or box types. The units also are available for gas fuel and combination gas and oil.

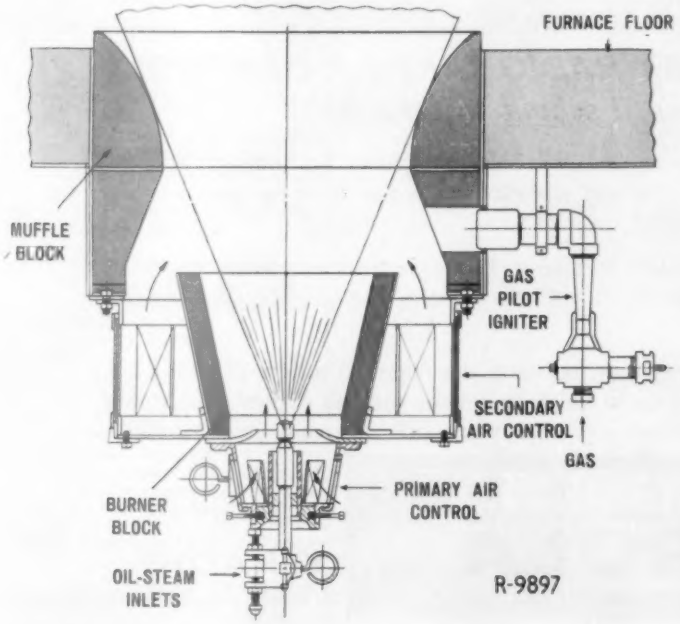
These modern CP oil units have added features that result in:

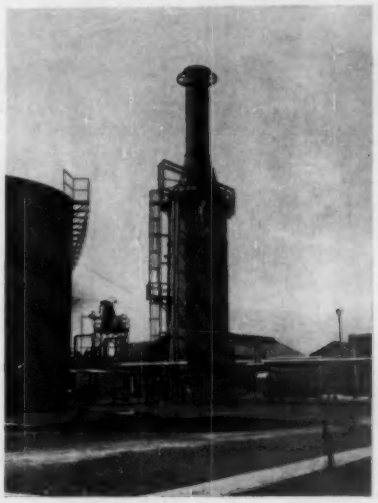
- **More stable fuel ignition.**
- **Higher economy of oil combustion with a minimum of excess air.**
- **Cleaner flames without dripping on heavy fuel oils.**
- **Flame patterns commensurate with furnace shape and arrangement of heat absorbing surfaces.**
- **Maximum radiation of heat from oil flame.**
- **Susceptibility to a varying demand of heat load.**

National Airoil CP oil units are available in six standard sizes that readily take care of the range of capacities most frequently specified. Two other special sizes are available for unusual conditions.

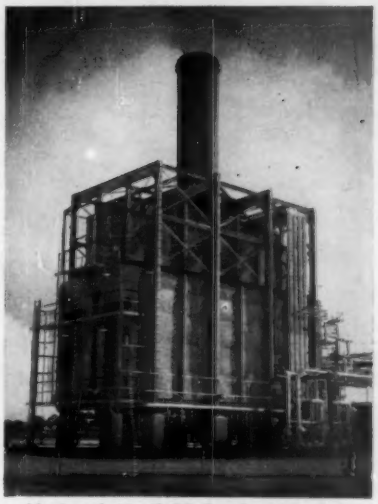
The units can be supplied to perform on natural or forced draft. On natural draft, they can be adapted to automatic combustion control, working the secondary air register. A different adjustment can regulate forced draft.

Where required, the CP units can be equipped with the dependable National Airoil Pilot-igniter Gas Burner for either continuous burning at 1% of the total heat load, or for intermittent operation as for ignition or start-up. Also, they can be furnished with the reliable National Airoil Electric Ignition System as used in chemical plants throughout the world.



Vertical cylindrical oil heaters perform more satisfactorily when operated with National Airoil CP Combustion Units.



National Airoil CP Combustion Units are ideal for use on horizontal tube, box furnaces like the one pictured here.

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A National Airoil Representative will be happy to discuss how these improved CP combustion units will assure increased performance in your installation. Descriptive literature is available. Write today.

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## PIPELINE CONSTRUCTION

sippi, and Louisiana, plus 17 miles of 24-in. loop from Lowry, La., to south of Iowa, La.
Status: Pending FPC approval.
Project: 41 miles of 26 and 16 miles of 20-in. gathering system from Gordy to Cow Island, La.
Status: Pending FPC approval.

**UNITED GAS PIPE LINE CO.,** Box 1407, Shreveport 92, La.
Project: 59 miles of 36-in. purchase lateral connecting Bastian Bay field, Louisiana.
Status: Pending FPC approval.
Completion: Fall 1961.
Project: 8 miles of 8-in. in Richland Parish, Louisiana.
Status: Under way.
Contractor: Loftin & Woodward, Inc., Delhi, La.
Completion: October 9, 1960.

**WESTERN SLOPE GAS CO.,** 900 Fifteenth St., Denver, Colo.
★ Project: 22 miles of 4-in. gathering line and ¼ mile of 6-in. from Powell Park field to Piceance Creek compressor station.
Status: Proposed.
Completion: October 30, 1960.
★ Project: 6 miles of 4-in. gathering line near Rifle, Colo.
Status: Proposed.
Completion: October 30, 1960.
Project: 6 miles of 6-in. from Palisade to Cameo, Colo,
Status: Proposed.
Completion: November 31, 1960.

## Canadian Crude Oil Pipelines

**ACT OILS, LTD.**
Project: A 450-mile line from the Peace River region to tidewater at Kitimat, B. C.
Status: Proposed.

**BITUMINOUS OIL PIPELINE CO.** (Royalite Oil Co., and Can-Amera Oilsands Development, Ltd.)
Project: A 250-mile line from Athabasca oil sands to Edmonton.
Status: Proposed.

**FEDERATED PIPE LINES, LTD.,** 304 Sixth Ave., SW., Calgary, Alta.
Project: 36-mile 16-in. loop on the Swan Hills-Edmonton line.
Status: Under way.
Contractor: Majestic Contractors, Ltd., Edmonton.

**INDEPENDENT PIPE LINE CO.** (Home Oil Co.), Calgary.
Project: 1,073 miles of 36-in. from Edmonton, Alta., to Superior, Wis.; 946 miles of 34-in. from Superior to Montreal, Que.; 72 miles of 16-in. and 74 miles of 10-in. feeder lines from Calgary to Bellshill Lake, Alta.
Status: Proposed.

**MATADOR PIPE LINE CORP.,** Denver.
Project: 175-mile line from Burke, Bottineau, and Renville counties, North Dakota, to Cromer, Man.
Status: Proposed. (See U. S.)

**MID-CONTINENT PIPE LINES, LTD.,** Edmonton, Alta.
Project: 1,500 miles of 30-in. from Edmonton to Chicago. U. S. section to be owned by International Oil Pipeline Corp., New York City.
Status: Pending Canadian Board of Transport Commission approval. W. C. Gilman & Co., New York City, has made preliminary study.

**NORTHERN PIPE LINE CO.,** 30 Broad St., New York 4, N. Y.
Project: 153-mile 16-in. line from Regina, Sask., to Clearbrook, Minn.
Status: Pending National Energy Board approval.
Project: 8 miles of 6-in., 45 miles of 8-in., and 17 miles of 12-in. from its Fox Creek Pump Station to Windfall, Virginia Hills, and Swan Hills fields in Alberta.
Status: Under way.
Completion: Fall 1960.

**PEMBINA PIPE LINE, LTD.,** Drayton Valley, Alta.
Project: 70 miles of 3 to 10-in. gathering lines in Pembina field.
Contractor: Mannix Co., Ltd., Calgary.
Completion: December 15, 1960.

**RANGELAND PIPE LINE CO.,** Calgary.
Project: 111-mile line from Cessford field to Calgary.
Status: Pending approval of Alberta government.

**TRANS-PRAIRIE PIPELINES, LTD.,** Edmonton.
Project: 130 miles of 8-in. from the Milligan Creek-Boundary Lake area to refineries at Taylor Flats and Dawson Creek, British Columbia.
Status: Under way.
Completion: By fall 1961.

## Canadian Products Pipelines

**BRITAMOIL PIPE LINE CO., LTD.,** Box 130, Calgary, Alta.
Project: 126-mile 6-in. line from Pincher Creek to Calgary.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.
Project: 64-mile 8-in. line from Dick Lake to Edmonton, Alta.
Status: Pending approval of the Alberta Oil and Gas Conservation Board.

**FOOTHILLS PRODUCTS PIPE LINE LTD.,** (Pembina Pipe Line Co., Mannix


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**4. NON-OVERLOADING** – Johnston high-pressure verticals have both a flat horsepower curve and steep head-capacity characteristic, making for economy and safe operation. With a Johnston, there is no danger of an overload.

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## PIPELINE CONSTRUCTION

Co., Ltd.), Calgary, Alta.
Project: 1,300 miles of 16-in. from Alberta to Chicago.
Status: Proposed.

**HUGHENDEN PIPELINE** (c/o British American Oil Co., Ltd., 800 Bay St., Toronto).
Project: 125 miles from Dick Lake gasoline plant to underground storage in the Hughenden region of eastern Alberta.
Status: Pending approval of Alberta Oil and Gas Conservation Board.

**PROVINCIAL PRODUCTS PIPELINES, LTD.**
Project: 700 miles of 4 to 12-in. line to pick up propane, butane, and condensates from natural-gas plants in Alberta for delivery to refineries and other plants.
Status: Pending approval of Alberta Oil and Gas Conservation Board.

**WESTALTA PRODUCTS PIPELINE, LTD.,** (Pembina Pipe Line, Ltd., Edmonton, Alta.).
Project: 885-mile 4 to 16-in. gathering system to take natural-gas liquids from plants in Alberta for delivery to proposed trunkline to Great Lakes area.
Status: Pending approval of Alberta Board of Public Utility Commissioners.

## Canadian Natural Gas Pipelines

**ALBERTA GAS TRUNK LINE CO., LTD.,** Calgary.
Project: 256 miles of 36-in., 75 miles of 30-in., and 199 miles of various diameter gathering lines. Main line is from Berland River, Alta., to Crows Nest Pass.
Status: Work to start fall 1960.

**ALBERTA NATURAL GAS CO., LTD.** (Pacific Gas & Electric Co., San Francisco, and Westcoast Transmission, Calgary).
Project: 108 miles of 36-in. across southeastern British Columbia to U. S. border near Kingsgate, B. C.
Status: Has Canadian and FPC examiner's approval.

**CANADIAN INDUSTRIAL GAS, LTD.** (formerly Ajax Petroleums, Ltd.), Derrick Building, Calgary, Alta.
Project: 28 miles of 10-in. and 4 miles of 8-in. from Morinville to Westlock Viking Sand field.
Status: Planned.
Completion: By September 1961.

**CARTIER GAS CORP.** (St. Maurice Gas, Inc. and Consumers' Gas Co., Toronto).
Project: 170 miles from Montreal to Quebec City.
Status: Proposed.

**GAS TRUNK LINE OF BRITISH COLUMBIA, LTD.,** Pacific Bldg., Calgary.
Project: 245-mile, 30-in. extension of Westcoast Transmission system from Taylor, B. C., to Fort Nelson.
Status: Under way.
Completion: December 1961.

**MAGNA PIPELINE CO., LTD.,** Nanaimo, Vancouver Island, B. C.
Project: 25 miles of 4.85-in. double flexible plastic pipe from Huntington, B. C., to Vancouver Island.
Status: Approved by British Columbia Public Utilities Commission. Tentative timetable calls for work to start by spring 1961.

**NORTHERN ALBERTA PIPE LINES, LTD.,** Edmonton, Alta.
Project: 110-mile trunk line, plus gathering system, from Lac La Biche, in

9001-HC

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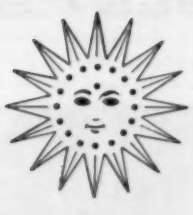

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## PIPELINE CONSTRUCTION

McMurray vicinity, to Edmonton.
Status: Pending provincial approval.

**NORTHERN NATURAL GAS CO.,** Omaha.
Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek, Alta.
Status: Proposed.
Project: 32 miles of 24-in. from Pincher Creek to Montana border to tie in with planned U. S. line on to Minneapolis.
Status: Proposed.

**QUEBEC GAS TRANSMISSION LINES, INC.,** 1610 Sherbrooke St. W., Montreal.
Project: 300-mile line from Montreal to Quebec City.
Status: Proposed.

**TRANS-CANADA PIPE LINES, LTD.,** Toronto.
Project: 390 miles of 34-in. main-line loop between Burstall and Winnipeg, Man.
Status: Planned. About 268 miles scheduled for construction in 1961, and 122 miles in 1962.

**UNION GAS CO. OF CANADA, LTD.,** 48 Fifth St., Chatham, Ont.
Project: 12 miles of 8-in. on the Woodstock-Norwich line in Ontario.
Contractor: Majestic Contractors, Ltd., Toronto.

**VAN TOR OIL & EXPLORATION CO.,** Vancouver, B. C.
Project: Line from British Columbia mainland to Vancouver Island.

**WESTCOAST TRANSMISSION CO. LTD.,** Calgary.
Project: 688-mile, 30-in. loop of British Columbia-Washington line.
Status: Proposed.
Project: (See Alberta Natural Gas Co., Ltd., for joint project).

## Foreign Crude Oil Pipelines

**ABU DHABIE MARINE AREAS, LTD.** (partly owned by British Petroleum Co., Britannic House, Finsbury Circus, London E.C. 2).
Project: 20 miles of 18-in. from offshore Persian Gulf pool to Das Island.
Completion: 1962.

**ARAB PIPELINE.**
Project: 1,250-mile pipeline from the Persian Gulf to Mediterranean.
Status: Proposed by Saudi Arabian Government and approved by the Arab League's petroleum department.

**ARABIAN AMERICAN OIL CO.,** Dhahran, Saudi Arabia, and 505 Park Avenue, New York.
Project: 73 miles of 30-in. loop on Safaniya-Ras Tanura line.
Status: Under way.
Contractor: Company personnel.
Completion: October 1960.

**BARNABO GROUP** (Italian interests).
Project: A line from Venice, Italy, to Innsbruck, Austria, which could then be extended to Munich, Germany.

**BASRAH PETROLEUM CO.**
Project: 20 miles of 16-in. from Zubair field to Shamiya.
Contractor: Mothercat Co., Ltd., Beirut, Lebanon.
Completion: November 1961.
Project: 65 miles of 30 and 32-in. from Zubair to Fao in southern Iraq.
Contractor: Turriff-Burden, Ltd., Tulsa.
Completion: 1961.

**BOLIVIA-PARAGUAY.**
Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.
Status: Planned.

**CREOLE PETROLEUM CORP.,** Caracas.
Project: About 14 miles of 8 to 24-in. gathering line in Lake Maracaibo.

**EASTERN BLOCK COUNCIL FOR MUTUAL ECONOMIC AID.**
Project: 2,500-mile "Vomecon" pipeline from the Volga-Ural oil fields in Russia to East Europe satillites.
Status: Construction under way in Poland, Hungary, and Czechoslovakia, with completion of latter section by early 1961. Partial operation of the over-all system expected in 1963.

**ENI (Italian state oil agency) and ITALO-SWISS FINANCE CO.**
Project: A 700-mile system from Genoa to Aigle, Switzerland, thence northeast to the German border, where it would split with one branch going to Munich and another branch to the Karlsruhe area. Feeder lines would go to Turin, Milan, and Cremona, Italy.
Status: The trunk line from Genoa to Aigle approved by the Italian Government.

**ESSO STANDARD (LIBYA), INC.**
Project: 100 miles of 30-in. from Zelten field to Gulf of Sirte.
Status: To start construction near the end of 1960.
Contractor: Bechtel Corp., San Francisco.
Completion: Mid-1961.

**GERMAN LINE** planned by eight German refining and marketing companies (British Petroleum, Esso, Deutsche Erdoel, Shell, Gelsenberg-Benzin, Mobil, Schloven-Chemie, and Wintershall).
Project: 160-mile, 22-in. line to Bavaria from Karlsruhe which is the northern terminus of the big South European Pipeline Co. project from Marseille to Germany.


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## PIPELINE CONSTRUCTION

Status: Planned.

**IRANIAN OIL EXPLORATION & PRODUCING CO.**
Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bander Mashur line.
Status: Planned.

**IRAQ PETROLEUM CO., LTD.,** 214 Oxford Street, London, W. 1.
Project: 28 miles of additional 30-in. loop in Syria.
Status: Under way.

**OASIS OIL CO. OF LIBYA,** 539 South Main St., Findlay, Ohio. (Other participants are Esso Sirte and Libyan American Oil Co.).
Project: 86 miles of 30-in. from the Dahra area of Libya to El Sider on the Mediterranean Coast, and 36 miles of 20-in. feeder line from the Mabruk area to the 30-in. line.
Status: Pending approval of the Libyan Petroleum Commission and the provincial government of Tripolitania.

**OIL INDIA, LTD.** (Burmah Oil Co. and Assam Oil Co., two-thirds, and India Government, one-third).
Project: 720 miles of line in northeast India. This will include 250 miles of 16-in. from Nahorkatiya to Noonmati and 470 miles of 14-in. from Noonmati to Barauni.
Contractors: Mannesmann, a German firm, will lay the 260-mile 16-in. system. Contract for the 460-mile 14-in. line has been awarded to an Italian Government company.
Status: To start November 1960.
Completion: The 16-in. system is scheduled for completion in March 1962.

**PETROLEO BRASILEIRO S.A. (Brazil).**
Project: 250-mile line from Rio de Janeiro to Belo Horizonte refinery site.
Project: 35 miles of 8 to 12-in. pipe from Buracica to Candeia.
Contractor: Techint, Inc., Milan, Italy.
Project: 80 miles of 24-in. to tie in to proposed Caxias refinery near Rio de Janeiro.
Status: Planned.

**ROYAL DUTCH-SHELL.**
Project: 12-mile line from Gore Bay, Australia, to Royal Dutch-Shell's Clyde refinery.
Status: Planned.
Project: 161 miles 20-in. line from Tandzung field to Balikpapan refinery, Borneo.
Status: Planned.
Contractor: Williams Brothers Overseas, Ltd., Tulsa, and John Brown, Ltd., London.
Completion: January 1, 1962.

**SHELL-BP PETROLEUM DEVELOPMENT CO. OF NIGERIA, LTD.,** 38/39 Marina, Lagos, Nigeria.
Project: 18 miles of 12-in. line from Port Harcourt to Bonny, Nigeria.
Status: Under way.
Constructor: African Construction Co.

**SOUTH EUROPEAN PIPELINE CO.** (Jersey Standard, Caltex, Shell, British Petroleum, and 12 other firms.)
Project: 419 mile 30-in. line from Lavera, near Marseille, to Strasbourg, with 40-mile extension to Karlsruhe, Germany.
Status: Construction to get under way by January 1961.
Completion: 1962.

**SYRIAN PIPELINE,** Damascus.
Project: 500-mile line from Karshuk field, Syria, to Mediterranean.
Status: Proposed.

**UNION OF SOVIET SOCIALIST REPUBLICS.**
Project: 2,315 miles of 28-in. Trans-Siberian crude-products line from Ufa

## PIPELINE CONSTRUCTION

and Tuimazy fields in Bashkiria to Irkutsk.
Status: Under way.
(See Eastern Block for information on new East Europe line).

**YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.**
Project: 390 miles of 14-in. from fields in Neuquen Province, Argentina, to Bahia Blancha.
Status: Bids received.
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: Planned.

**YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS, La Paz.**
Project: 407-mile 12-in. line from Camiri to Sica Sica.
Status: Proposed.

## Foreign Products Pipelines

**ARABIAN AMERICAN OIL CO., Dhahran, Saudi Arabia, and 505 Park Avenue, New York.**
Project: 37 miles of 8-in. LPG line from Abqaik to 'Ain Dar.
Contractor: Company personnel.
Completion: 1961.
Project: 6½ miles of 6-in. LPG line from Ras Tanura refinery to the terminal.
Status: Under way.
Completion: Fourth quarter 1960.

**ESTRADA FERROVIARIA SANTOS A JUNDIAL, Sao Paulo, Brazil.**
Project: 25 miles of 6-in. ethylene line from Cubatao to Rio Grande.
Contractor: Techint, Inc., Milan, Italy.

**NATIONAL IRANIAN OIL CO., Teheran.**
Project: 510 miles of 8-in. from Teheran to Meshed, Iran.
Status: Under way.
Contractor: Williams Brothers, Tulsa, has contract for about half this project.

**NORTH ATLANTIC TREATY ORGANIZATION (Bid details from Bureau of Foreign Commerce, U. S. Department of Commerce, Washington).**
Project: 57 miles of 8-in. in Germany to Land Baden-Wuerttemberg air field.
Project: 93 miles of 6-in. in Turkey.

**PETROLEOS MEXICANOS.**
Project: 291 miles of 8-in. from Torreon to Chihuahua.
Completion: March 1961.

**PIPELINES OF PUERTO RICO, San Juan.**
Project: 95 miles 8-in. from Penuelas to Catano.
Status: Approved by Puerto Rican Public Service Commission.

**SYRIAN PIPELINE.**
Project: About 310 miles from Homs to tank farms in the Damascus, Aleppo, and Latakia areas.

**UNION OF SOVIET SOCIALIST REPUBLICS.**
Project: 2,315 miles of 29-in. Trans-Siberian crude-products line from Ufa and Tuimazy fields in Bashkiria to Irkutsk.
Status: Under way.
Project: 700 miles from Novo-Kuibyshev refinery to Bryansk.
Status: Under way.

**YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.**
Project: 652 miles of 10-in. from Lujan de Cuyo to Buenos Aires.
Status: Planned.

## Foreign Natural Gas Pipelines

**BASRAH PETROLEUM CO., LTD., 214 Oxford St., Oxford Circus, London W. 1, England.**
Projects: 65 miles of 12 to 16-in. line from Zubair to Fao, Iraq, and 19 miles of 12-in. from Zubair to Rumailah.
Contractor: Mothercat Co., Ltd., Beirut, Lebanon.
Completion: April 1961 for line to Fao and October 1961 for Rumailah line.

**CREOLE PETROLEUM CORP., Caracas.**
Project: 18 miles of 30-in. and about 13 miles of 8 to 24-in. from stations in Bachaquero area to the Bachaquero compressor plant.
Status: Under way.
Completion: October 1960.

**GASES NATURALES DE COLOMBIA, S.A. (Owned 50% by Colombian Petroleum Co., which is affiliated with Mobil International and Texaco, and 50% by local interest.)**
Project: 140 miles of 10-in. from Cicuco field to the Caribbean port of Barranquilla.
Completion: Late 1961.
Project: 75 miles from Rosh-Zohar field to Ashdod Yam.

**INDIA.**
Project: India plans to start formal talks with Pakistan soon concerning possibility of importing natural gas from Sui field into India.
Status: Preliminary studies indicate a pipeline to Bombay might be commercially sound.

**MENE GRANDE OIL CO., Caracas.**
Project: 19 miles of 12-in. from East Soto to Zapatos.
Completion: 1960.

**MEXICAN LINE.**
Project: A 1,100-mile, 34-in. line from Reynosa, near the southern tip of Texas, to San Luis Rio Colorado, near the California border.
Status: Preliminary agreement signed by Petroleos Mexicanos and Tennessee Gas Transmission Co., Houston..

**PAKISTAN INDUSTRIAL DEVELOPMENT CORP.**
Project: 1,000-mile system to carry gas from Sui field northward from Multan to Lyallpur, Lahore, Daudkhel, Islamabad, Rawalpindi, and Wah. This would require a loop to an existing 310-mile 16-in. line from the Pakistan petroleum field to Multan.
Status: Under consideration. Technical survey has been ordered.

**PAKISTAN PETROLEUM CO.**
Project: 145 miles of 8-in. from Sylhet field to Daccq, East Pakistan.
Status: Proposed.

**PETROLEOS MEXICANOS.**
Project: 483 miles of 24-in. from Jose Colomo field in State of Tabasco to Mexico City.
Status: Under way.
Contractors: Condusa is contractor. Contracts for eight river crossings awarded to Collins Construction Co., Port Lavaca, Tex., and Constructora Inde S. A. de C. V., Mexico City.
Completion: November 1960.
Project: 200 miles of 14-in. from Mexico City to Salamanca.
Status: Planned.
Completion: September 1961.
Project: 291 miles of 12-in. from Torreon to Chihuahua.
Completion: March 1961.

**QATAR GOVERNMENT.**
★ Project: 65 miles of 10-in. from Dukhan to Doha.
Contractor: Mothercat Co., Ltd., Beirut, Lebanon.
Completion: April 1961.

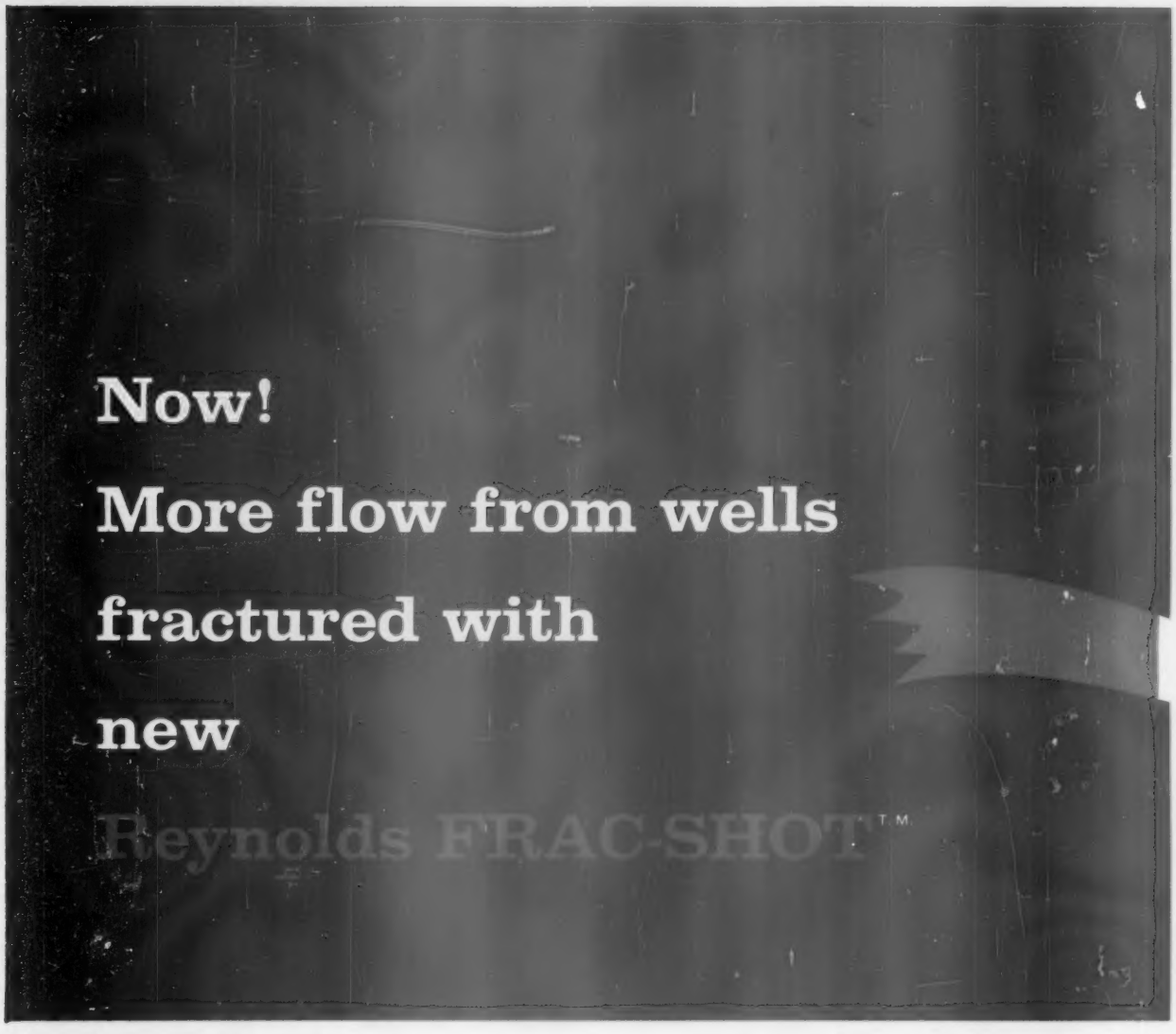
**SOC. SICILIANA METANADOTTI (SOSIM). Partners include Edison Power, Italcementi, Fiat Motor, Sicilian SGES Power, Bombrini Parodi Delfino Chemical, and Montecatini.**
Project: 560 miles from Hassi R'Mel gas field, Algeria, to Cape Bon, Tunisia, 77 miles across the Sicilian Channel, into northern Italy and beyond.
Status: Engineering studies under way.

**SOTHRA.**
Project: A 315-mile system from Hassi R'Mel gas field in Algeria to the Mediterranean Coast, including 262 miles of 24-in. trunk from Hassi R'Mel to Relizane and 20-in. from Relizane to Arzew, plus branches to Oran and Algiers.
Status: Under way.
Contractors: Groupement Entrepose-Ste. Parisienne pour l'Industrie Electrique (GREP) has contract for 200 miles from Hassi R'Mel to Tiaret. Socoman has contract for 115 miles from Tiaret to Arzew.
Completion: Spring 1961.

**STANDARD-VACUUM OIL CO., New York.**
Project: 60 miles of 8-in. from Radja field to Palembang, Sumatra.
Status: Planned.

**UNION OF SOVIET SOCIALIST REPUBLICS.**
★ Project: 250-mile line from Ust-Vilyuisk field to the Siberian cities of Yakutsk and Pokrovsk, plus feeder lines to supply villages in the Lena River Valley.
Status: Planned.
Completion: Date not set yet.
Project: Two parallel, 40-in. lines, each over 1,300 miles long, from Gazli, near Bukhara, northward to Sverdlovsk and Chelyabinsk.
Status: Planned.
Project: Line from Samarkand through Tashkent to Chimkent, Dzhambul, Frunze and Alma-Ata near Chinese border.
Completion: Line from Samarkand to Tashkent expected to be finished in 1960. Completion of rest of line expected by 1965.
Project: Line from Berezovo field southward to Sverdlovsk.
Status: Proposed.
Project: 438 miles from Dashava in Carpathian Mountains to Minsk.
Status: Under way.
Completion: 1960.
Project: Line from Minsk northward to Baltic Sea area.
Completion: To Vilnius, Lithuania, in 1961; to Riga, Latvia, in 1962.
Project: Line from Minsk northeast to Leningrad.
Status: Proposed.
Project: 405 miles from Saratov north to Gorki via Penza.
Status: Under way.
Completion: 1960.
Project: 800-mile, 32-in. loop of existing line from Stavropol fields in northern Caucasus to Moscow.
Status: Under way.
Completion: 1960.
Project: 800-mile, 40-in. line from Krasnodar fields north of Caucasus Mountains to Serpukhov, south of Moscow, via Rostov and Lugansk.
Status: Under way.
Project: 310-miles of 32-in. line ringing Moscow at radius of about 50 miles.
Status: Under way.
Completion: 1962.

**YACIMIENTOS PETROLIFEROS FISCALES (Argentina), Buenos Aires.**
Project: 1,000-mile line from Comodoro Rivadavia to Buenos Aires with a spur to Plaza Huincul field in Neuquen province. Line will be 26 in. to the connecting point for the Plaza Huincul link and 30 in. from the connection to Buenos Aires.
Status: Proposed.




Now well fracturing can be more effective than ever before . . . making wells many times more productive!

A new propping agent, FRAC-SHOT, makes the difference.

FRAC-SHOT, a Reynolds Metals Company development, is aluminum "shot"—malleable pellets of aluminum. The process using aluminum shot has been developed by The Atlantic Refining Company, and patents are being issued.

Wells fractured with FRAC-SHOT in field tests have produced several times the flow of those fractured with conventional materials in the same fields. This increase is achieved because the conductivity of the fracture has been increased substantially. This is especially desirable where formation permeability is in the medium-high range. And this is where FRAC-SHOT pays its biggest dividends, according to results obtained by The Atlantic Refining Company.

The FRAC-SHOT aluminum pellets are strong and malleable; they will deform slightly under severe well conditions, but will not be crushed or pulverized. Thus, with FRAC-SHOT, the fracture is held open. Flow is not constricted as it is with other proppants. Although aluminum FRAC-SHOT is slightly higher in cost than conventional materials, it more than pays for itself in additional production.

FRAC-SHOT is another of the developments in aluminum by the pioneer and leading supplier of this metal for the petroleum industry—Reynolds.

New FRAC-SHOT aluminum pellets provide better support for fractures, increase well flow several times over ordinary fracturing methods.

You'll find many other Reynolds developments, and Reynolds Aluminum working in all phases of the industry, improving production, reducing costs: in lightweight drilling rigs, Oil Country Pipe, service lines, offshore drilling structures, tanks and vessels, and in a wide range of equipment.

FRAC-SHOT is available from any of the following major service companies:

B. J. Services, Inc.
Dowell Division of Dow Chemical Co.
Halliburton Company
The Western Company

Or, for information on FRAC-SHOT, or on any aluminum application for the petroleum industry, contact the people who know aluminum for petroleum—your local Reynolds office, or write *Reynolds Metals Company, P. O. Box 2346-ER, Richmond 18, Virginia.*

# REYNOLDS ALUMINUM

Watch Reynolds new TV show "Harrigan & Son", Fridays, starting October 7; also, "All Star Golf", Saturdays, resuming October 15—ABC-TV. And on Sunday, October 16, be sure to see the exclusive showing of America's new 1961 cars on The National Automobile Show, direct from Detroit over CBS-TV, 6 to 7 P.M. EDST.

Visit the Reynolds booth at the Society of Petroleum Engineers fall meeting, Denver, Colorado, Oct. 2-5, 1960

# Exclusive LUFKIN Chrome Clad® lines won't rust, chip or peel

**The bold, black markings are bonded to steel** . . . protected by layer on layer of electroplating . . . topped by a final coat of chromium!

**Exclusive quality features** are yours in all Lufkin tapes. For example:

**Lufkin "Atlas" Gaging Tape** (above, left) is easy to read with durable, jet-black markings on glare-free, chrome-white line. Extra *sturdy* line, 50% heavier than standard weight. 20-ounce plumb bob. Lock-handle frame.

**Lufkin Chrome Clad Anchor Tape** (above, right) is available with easy-to-read markings in feet, tenths and hundredths, in genuine-leather, hand-stitched case. The handiest thing you can carry, on job after job.

See your Oil Supply House.

*Measure for measure, the finest made...*

LUFKIN

SAGINAW, MICHIGAN

## ▶ ▶ ▶ New Equipment Section

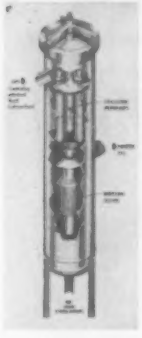
# This week's SHOWCASE features . . .

### Car-top sleeper for three persons

. . . is available. Called a Camp Queen, the sleeping unit is claimed to be quickly detached from a vehicle and suspended from the roof of a garage by ropes and pulleys. It weighs 125 lb., including mounting brackets.

To erect the enclosure, raise the cover and tighten thumb screws on telescoping cover-support rods, then tilt the back canvas support frame, which is hinged to the floor at the rear, into position and secure it by two thumb screws. A retractable step provides access to the tent floor from the deck lid of a car or tail gate of a station wagon. Source: **Bennett & Co., 4721 E. El Segundo Blvd., Compton 2, Calif.**

### Entrained hydrocarbons



. . . removed from compressed air and gases with an new product now on the market called a coalescer-demister. Using a system of porous materials, the product first coalesces into larger-sized droplets and removes from the system entrained liquids in the form of small droplets and mist. Any droplets remaining in a system are further processed and removed by a demisting section. The unit is made in capacities up to 7,000 c.f.m. at pressures up to 200 psig. Source: **Selas Corp. of America, Dresher, Pa.**

●

### Quick-opening closure

. . . for scraper traps, gas scrubbers, pipeline strainers, and pressure vessels provides a quick-opening fitting with a closure head having a beveled seat and O-ring gasket. The closure head is axially movable on an overhead arm which swings laterally about a pedestal to expose the open end of the body.

Closure head is moved by a hand crank attached to a threaded shaft in the overhead arm. After a threaded nut is unscrewed from the body, the complete head can be swung 90° about the pedestal. The closure comes in 12 through 28-in. nominal pipe diameters for vertical or horizontal installations. Pressure rating is 600-lb. ASA. Source: **Moorlane Co., Box 1679, Tulsa 1, Okla.**

●

### Valve

. . . handles liquids, vapors or solids and is said to shut off tight in both pressure and vacuum applications. The Uni-Seal butterfly valve uses only one seal. No packing is required. A floating disk on the stem automatically adjusts itself and seeks true center on a one-piece seat made of synthetic rubber bonded to steel.

The valve comes in three sizes, 2, 3, and 4-in., with a choice of four end connections: screwed, grooved, flanged, and weld-end. Working pressure: 175-psi. w.o.g. Source: **Drilling Equipment Mfg. Co., 845 S.E. 29th, Oklahoma City, Okla.**

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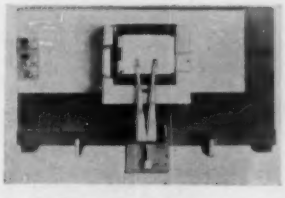

### Chart integrator

. . . gives three values from a single run, the maker claims. These are the chart extension for differential and static pressure and readout values for average absolute static pressure and average differential pressure.

The chart integrator handles both strip and conventional charts through


**Want more facts about equipment or copies of product literature described in this issue?**

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to manufacturer at address shown in bold type after each item.

Product name, Model no., literature title or number: .....

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Described in OIL AND GAS JOURNAL - Issue of **September 26, 1960**

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CITY..... STATE.....

**For General Use buy**

**RIDGID**

**Heavy-Duty**

**Pipe Cutters**

Factory tested for perfect tracking, here's your best cutter buy for hand use. Extra-long shank protects threads, gives fast, easy adjustment. Large handle for sure grip . . . more leverage. Strong, special malleable frame won't bend or warp. You'll also need the RIDGID Wide-Roll Cutter, that tracks perfectly at high power-drive speeds, and the RIDGID 4-Wheel Cutters, that give quick, clean cuts in tight places with only quarter turns.

Five Sizes for ⅛" to 6"

**For Tubing and Thin-Wall Conduit buy**

**RIDGID**

**Tubing Cutters**

Five Sizes for ⅛" to 4"

Exclusive fold-in reamer on Nos. 10, 15 and 20 protects hands and pockets . . . reams full cutter capacity. Single thin-blade wheel gives quick, clean cuts. Rollers smooth tubing ready for soldering.

Only special No. 315 is 3-wheel cutter for fast cuts in hard-to-get-at places.

There's a RIDGID Cutter to save you time on every job. Call your Supply House today!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

**"I've ALWAYS preferred KING GA SWIVELS"**

King Swivels 32GA and 53GA have been popular for many years. They have proved to be rugged, dependable and durable, and are in use around the world because they are "preferred". The fact that King Oil Tools is the largest manufacturer of lightweight swivels is supporting evidence of King engineering, service efficiency and complete all-around dependability.

INDUSTRY RECOGNIZES KING GA SWIVELS BY THESE FAMOUS FEATURES:

- ALLOY STEELS assure strength with minimum weight.
- PACKING is V-type, often called chevron type.
- WASHPIPES are seamless alloy tubes, case-hardened and ground.
- GREASE LUBRICATION for the packing.
- MULTIPLE BALL BEARING UNITS provide ample capacity.
- OIL BATH LUBRICATION for the bearings.
- Choice of BAIL OR ELEVATOR SHANK.

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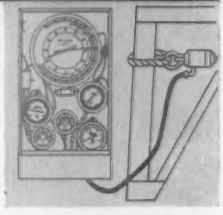
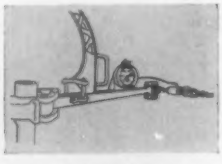
**TONG TORQUE**

THE MARTIN-DECKER **TONG TORQUE ASSEMBLY** FOR ALL CONNECTIONS



**PERMANENT INSTALLATION** The cylinder attached to the back-up line provides torque indication each time collars are run.



**PORTABLE INSTALLATION** The torque assembly attached to the tong itself can be used for spot checks on two or more rigs.

**NE GAUGE** for torque measurements of all size drill collars, drill pipe, tubing and casing.

**ACCURATE AND RELIABLE** readings with calibration checks seldom required.

**CARE AND MAINTENANCE** can be capably done by the drilling crews.

**MARTIN DECKER**

WRITE FOR DESCRIPTIVE LITERATURE D-P95
MARTIN-DECKER CORPORATION
3431 CHERRY AVENUE, LONG BEACH 7, CALIF.

*World's principal manufacturer of Oil Well Drilling Instrumentation*

use of an adaptor plate supplied with the instrument. According to the maker, the integrator provides greater efficiency in chart interpretation and causes less eye strain and fatigue than older models. For ease in checking records, follower pens superimpose a light ink line on the original chart record. Source: **American Meter Co., 920 Payne Ave., Erie, Pa.**

●

## Two-zone subsurface pump

. . . now being produced features an upper-pump standing valve, which consists of a drop and seat, that is said to give the multizone pump the same operating efficiency of any standard pump as well as the operating flexibility required in multiple-zone completions.

The complete pump is said to be retrievable on the sucker-rod string. The D+B pump comes in these types: two packer; one packer with hollow sucker tubes; one-packer parallel installations with either two or three tubing strings; and triple completions, two or three-packer. The two-packer and the one-packer types with hollow sucker rods come in 4½ to 7-in. casing sizes; the others in 5½ to 7 in. Source: **Continental-Emsco Co., Box 359, Dallas, Tex.**

●

## Latest rigs

. . . for well service and workover are a self-propelled drive-in type. Model 200 has a depth rating of 8,000 ft. with a nominal range of 150 to 250 hp. Model 300-B has a rating of 12,000 ft. with a nominal range of 250 to 350 hp. Single-engine power units drive the truck and rig through a torque converter and transmission with three forward and one reverse speed.

Two types of masts, a folding and a telescoping type, can be used with each rig. Both can be raised in about 2 minutes by a multistage hydraulic ram. Mast heights are about 88 ft. for Model 200 and 97 ft. for Model 300-B. The folding outriggers have a spread of 16 ft. between centers, which makes ground guys unnecessary, the maker points out. Source: **National Supply Co., 2 Gateway Center, Pittsburgh 22, Pa.**

●

## Pump dimensions

. . . matched to motor provide mounting ease. The dimensions of each pump in this new Adapt-Able line of centrifugal pumps are designed to align with those of NEMA-rated motors. The pumps are so constructed that the pump frames receive size volutes and impellers.

One advantage of the pumps is that standardization of their dimensions with NEMA motor-frame dimensions permits their installation without makeshift height-adjusting blocks and odd-bore couplings. Consequently, the most economical frame size can be selected to match the motor-horsepower requirements of the pumping job. Source: **Fairbanks, Morse & Co., Pump & Hydraulic Div., 600 S. Michigan Ave., Chicago 3, Ill.**

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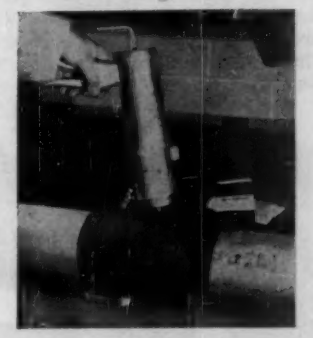


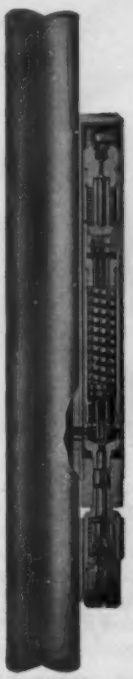
## Epoxy resin

. . . repairs pipe leaks in a new method recently developed which is claimed to be a fast way to repair pipe of any diameter operating at pressures up to 100 psi.

The epoxy used is called Scotchcast electrical resin No. 4.


# GAS LIFT AUTOMATION

**with Macco "Spring" Fluid Operated Valves**
("No Charge" Bellows)



CM2-FS

The MACCO Fluid Operated Valve is actuated by a predetermined hydrostatic fluid head in the tubing.

INTERMITTENT FLOW . . . The intermittently produced gas-lift well normally has a producing capacity of less than 500 bbls. per day and fluid is produced at intervals in "slugs." When the fluid column in the tubing builds up sufficient pressure, at the valve, to overcome the valve opening pressure, the valve stem is lifted off its seat. Then gas from the casing is injected through a normally closed check valve into the tubing, discharging the accumulated head of fluid.

When the tubing pressure opposite the valve becomes lower than the valve opening pressure, the valve immediately closes until another predetermined head is built up in the tubing and the cycle is repeated. Subsequent action is automatic and unloading from valve to valve is automatic. No time cycle surface controllers or "purgers" are necessary.

*CONTINUOUS FLOW* . . . If a well condition is such that the flowing bottom hole pressure will feed past the point of injection at a rate sufficient to maintain a pressure opposite the valve greater than the valve opening pressure, the delivery of fluid from the flow string is constant.

For further information regarding lifting with Macco Fluid Operated Valves, write for Brochure Nos. 3-10, 3-11, 3-12 & 3-13.

MACCO

**MACCO OIL TOOL COMPANY, INC.**
1521 Prince P. O. Box 7288 Houston 8, Texas
Phone UN 1-1253

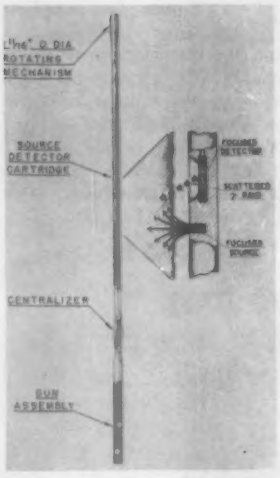
MACCO equipment is also available in sterling areas from Williams & James (Oil Tools) Ltd., Gloucester, England

To repair pipe, the area is cleaned and dried, then the hole covered with folds of the maker's No. 22 electrical tape. Next, a steel pressure band is applied to the folds of tape. Following this, a screen-like tape is wrapped around the pipe to serve as a mold body for the resin. An injection fitting is placed over the spacer tape and a layer of cloth-restricting tape is wrapped over the vinyl electrical tape. After it is mixed, resin is then injected into the voids. The resin reportedly cures in less than 2 hours. Source: **Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.**

## Perforations

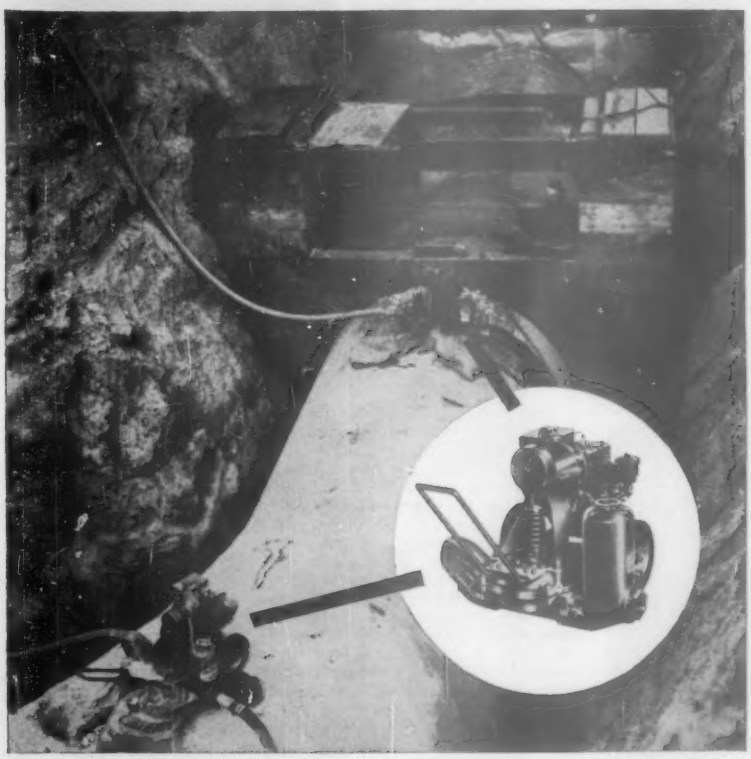
. . . oriented on one line with a new development comprising a radiation-sensing device, a rotation mechanism, and the maker's Scallop gun or Ribbon Jet perforator. The 1 11/16-in. diameter of the orienting equipment allows its use in pipe as small as 2⅜-in. o.d.

Advantages cited for the new single-line equipment over older equipment are that it reduces the requirements in surface equipment and operating time, adjacent strings need not be open, and sucker rods or other well equipment may remain in place.




The mechanical rotating device is actuated by moving the cable a few inches up and down. This rotates the gun in steps of 30°. Source: **Schlumberger Well Surveying Corp., Box 2175, Houston, Tex.**


# 57 DIAPHRAGM PUMPS ON THIS JOB...AND 47 ARE GORMAN-RUPP



The Brea (California) pipeline job consists of 14 miles of 96″ cement-coated steel pipe. Diaphragm pumps were selected because they can be easily moved from bell joint as the welders progress. Contractors: Morrison-Knudsen, Inc. and Macco Corp. of Los Angeles.

Gorman-Rupp Diaphragm pumps are by far the favorite of contractors. These exclusive features show why: diaphragm drive rod spring-cushioned on down-stroke; suction accumulator for smooth pumping flow; antifriction, helical-ground gears and bearings operate in oil; one-man handling, engine-driven 3″ pump only 120 lbs., job-to-job.

Isn't it time you tried a Gorman-Rupp Diaphragm pump?

**THE GORMAN-RUPP COMPANY**
**305 Bowman Street • Mansfield, Ohio**
Gorman-Rupp of Canada, Ltd., St. Thomas, Ontario

## System tests

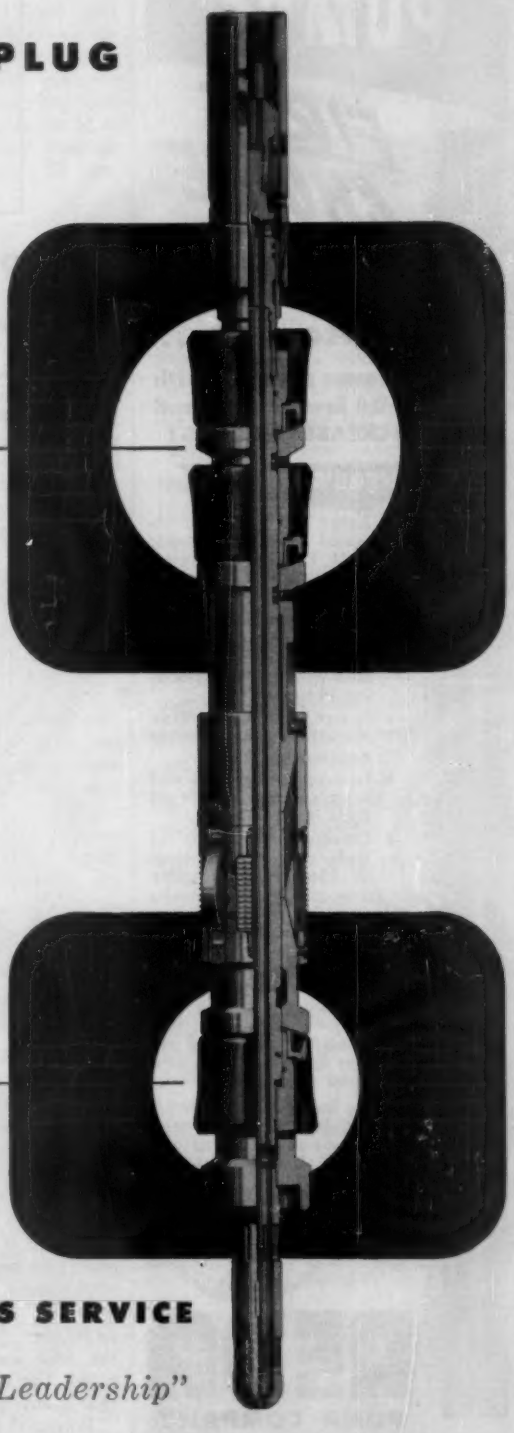
. . . 25 wells automatically or any multiple of 25 oil wells, the maker says. Designated the Automatic Well Test and Data Panel Model WT-300, it is said to give complete automatic control of all testing functions.

It is rack-mounted with pullout drawer modules. Each 25-well module is equipped with a purge timer, test timer, and skip-test well-selector switches.

Oil, gas, and water counters tabulate and store data during tests. An electric typewriter automatically types out test data at the end of each well test period. Typed data consists of the volume of oil, gas, and water, date, time, and well code number. This data is printed in a maximum of 10 seconds. Source: **Instruments, Inc., Box 556, Tulsa, Okla.**

# *automatically!* LEAK-PROOF SEALING

## with HALLIBURTON CUP TYPE RETRIEVABLE BRIDGE PLUG



...cups *seal automatically* to provide a leak-proof plug against pressure from either direction...completely retrievable.

The Halliburton Cup Type Retrievable Bridge Plug when used with the Halliburton Retrievable Test-Treat-Squeeze (RTTS) Packer is the compatible combination in testing, treating, and squeezing procedures for isolating one or multiple zones individually – with unlimited spacing and no flow restriction – permits "straddling" of any desired section... *with only one trip into the hole.*

## EASY TO SET–ECONOMICAL TO USE

When tool is set and released *automatically* at desired location in cased hole, cups *seal* by application of pressure differential from above or below. Equipped with the locking mechanism of a J-slot arrangement that allows the Bridge Plug in retracted position to be moved from one interval to another and be re-set or completely removed from the hole. Constructed for drilling-out, if conditions require.

Ask your Halliburton operator about this Retrievable Bridge Plug and how it will save you time – compared to ordinary drillable plugs for temporary bridging.

# HALLIBURTON

**SPECIAL TOOLS SERVICE**

HALLIBURTON COMPANY • DUNCAN, OKLAHOMA

*"Continue to Look to Halliburton–for Leadership"*

275 SERVICE CENTERS—TO SERVE YOU BETTER

# REDA PUMPS

## FIRST CHOICE

**FOR SECONDARY RECOVERY WATER FLOODING . . .**

**because pumping with REDA lowers costs and INCREASES PROFITS!**

**HERE'S HOW:**

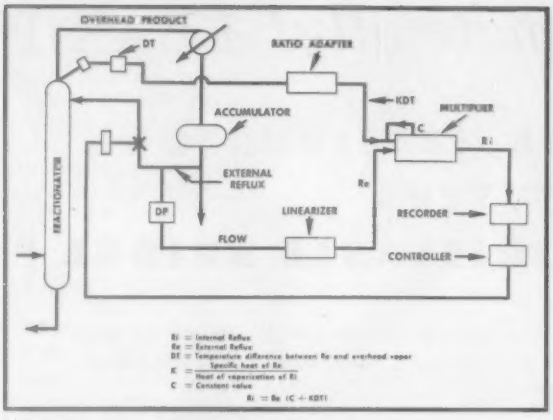
- Large water volume obtained from smaller size well casings reducing number of supply wells necessary
- Flexibility of Reda Pumps in meeting changing water requirements common to most waterflooding projects
- Easier, less expensive installation and lower maintenance costs
- Low operating costs and long operating life of Reda equipment
- Corrosion resistance of Reda pumps is superior to any other pumping unit used in supply wells

Reda Submergible Pumps are a major factor in the success of waterflooding and pressure maintenance operations. They are being used in major floods with very successful results of increased production and lowered costs.

Write for complete information today! Reda engineers will be pleased to call and assist in planning operations.

SIGN OF QUALITY . . SUBMERGIBLE REDA PUMPS

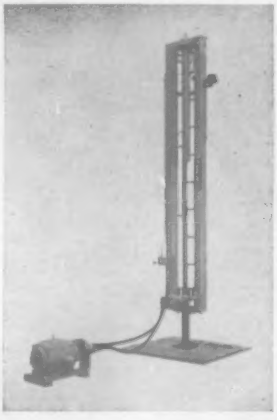
**REDA PUMP COMPANY**
**BARTLESVILLE, OKLA**


## Control for fractionating towers

. . . offers a way to prevent column upsets due to the effect of ambient-temperature changes on external reflux. The Internal Reflux computer uses a control method developed and licensed by Phillips Petroleum Co. The maker's standard electronic instrument components are used to compute internal-reflux flow and keep the flow constant.

Internal reflux flow is computed from measurements of external-reflux flow rate and temperature difference between overhead product and external reflux. The instrument maintains a constant internal-reflux flow by regulating a valve on the external-reflux stream. Source: **Swartwout Div., Crane Co., Hooksett Industrial Park, Manchester, N. H.**



## Hydraulic pump unit

. . . is a 36-in.-stroke surface type, available in two polished-rod load capacities: 3,500 and 5,000 lb. Both Hydrax units are complete and include a choice of direct-drive electric motor or V-belt drive for an engine.

The unit mounts directly on tubing nipple. No foundation is required. Operation is reportedly simple as only one valve needs adjustment, for downstroke speed only. A vertical reservoir mounted on the wellhead provides a large area for cooling and separates the unit and the wellhead polished rods. The unit uses an external filter that is easy to get to for maintenance.

Potential uses include wells having sand problems. The unit's slow upstroke minimizes the amount of sand drawn into subsurface pump. According to the maker, the unit will handle wells from the stripper type to those producing over 100 bbl. a day. Source: **Axelson Div. of U. S. Industries, Inc., 6160 S. Boyle Ave., Los Angeles 58, Calif.**

## Glycol pump

. . . operates on less gas for the quantity of glycol pumped than older gas-powered types, the maker claims. The Series 8000 pump is said to be easily maintained because of a simple design. To prevent glycol contamination, the rich and lean glycol solutions are isolated. Pump capacities range from 6 to 60 gal. per hour at pressures from 300 to 1,500 psi. Deep sections of packing and cast-iron piston rings are used instead of O-rings as dynamic seals. These are claimed to provide long operating life. Source: **Texsteam Corp., 320 Hughes St., Houston, Tex.**

SHOWCASE . . .

# New Literature

## Portable and fixed-mounting mixers

. . . known as Lightnin, are introduced in two bulletins being offered free upon request. Designed as integral units, the mixers, the publications claim, offer increased mixing efficiency, improved handling convenience, and maintenance-free operation. Source: **Mixing Equipment Co., Inc., Box 1370, Rochester 3, N. Y.**

## Float-valve bubble trays

. . . Brochure C-6-0 deals with the fundamentals of design and operation, mechanical features, operating results, and general design arrangement of the trays. The 12-page literature includes 86 companies that have had experience with the equipment. Source: **Nutter Engineering Co., Box 7008, Tulsa, Okla.**

## Analog computer

. . . automatically and continuously measures and records the mass flow on an ElectroniK recorder. Four-page Instrumentation Data Sheet 7.08 covers application of the gas-flow computer for single and multiple meter runs and for telemetering systems. Source: **Industrial Div., Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa.**

## Surface casing

. . . for rotary wells is outlined in a four-page literature piece just made available. It presents physicals, dimensions, and threading data on both threaded and slip-joint surface casing. Source: **Naylor Pipe Co., 1230 E. 92nd St., Chicago 19, Ill.**

## Low first cost

. . . versus low ultimate cost is discussed in a new 12-page booklet which deals with the conflict between low-dollar first costs and long-range economy. The booklet emphasizes that the calculation and evaluation of the eventual profitability of capital process equipment can no longer be a matter of "guestimates" or conjecture, but must be based on the practical facts of economic life. It discusses the question, "When is a low bid really low?" and points out factors that must be considered to arrive at the proper answer. Source: **Heat Exchanger Div., Western Supply Co., Box 1888, Tulsa, Okla.**

## Dry scrubber

. . . uses centrifugal force to separate solid and liquid particles from gas. Bulletin 7-50 (four pages) offers information on operation, capacity, pressure loss, construction, and advantages. It includes a cutaway and line drawing which illustrate its principal of operation. Source: **Peerless Mfg. Co., Box 13165, Dallas 20, Tex.**

## Wide-spectrum biocide

. . . for use in treating water-injection systems, producing wells, and water disposal systems, is the subject of a new bulletin just issued. Effective against most microorganisms, Hagan B-2 is said to be exceptionally toxic to sulfate reducing bacteria even in concentrated brines. The literature reports that the biocide provides protection against corrosion by forming a protective organic film on metal surfaces. Source: **Oilfield Div., Hagan Chemicals & Controls, Inc., Hagan Center, Pittsburgh 30, Pa.**

## Technical talk

. . . on mastic coatings, an edited version of a recent speech, is contained in an available publication. It discusses the meaning of "mastic coating" and describes various additive ingredients which make up the many different final products available. Both applications and limitations of mastics are covered. Bulletin M-1 includes information on proper preparation of the surface and application of the material. Source: **Emjay Maintenance Engineers, Box 111, Rutherford, N. J.**

## Pipe connections

. . . and accessories designed on the new Grayloc seal principle are described and illustrated in a 44-page catalog, free upon request. It contains new types and ratings of clamps, collar-type unions, flanges, vessel nozzles, closures, and bleeder valves. Products with related applications are also catalogued, including bi-metallic pipe and fittings. The new literature features an exclusive 10-page table of allowable working pressures for pipe and connections from 1 to 30 in. up to 1,500° F. Also tabulated are relative costs of 39 piping materials. Source: **Grayloc Sales Div., Gray Tool Co., Box 2291, Houston 1, Tex.**


Let R-u-b-b-e-r Take The Wear

in your sucker rod pumps

IT COSTS YOU LESS THAT WAY

● MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.

● MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.

● The replaceable SYNTHETIC RUBBER GUIDES in MARTIN CAGES last longer than any metal, and the cushioning of the ball increases your ball & seat life. Results are often truly amazing. (Patent No. 2,591,174)

*Write for our new 1960 catalog or see it in the new Composite (24th Edition). All products sold thru supply companies.*

JOHN N. MARTIN

*Manufacturer*

[illegible] BRADY STREET • TULSA, OKLAHOMA

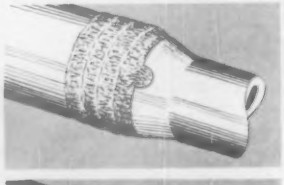
## Why you should specify

# AMERICAN IRON

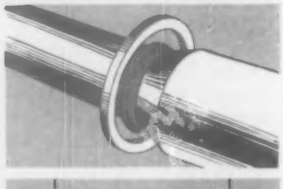
## *Flash Welded* TOOL JOINTS

***on your next string of drill pipe!***

**Here are three of the many reasons why you buy QUALITY when you specify AMERICAN IRON.**



1. TUNGSTEN CARBIDE Hard Metal Bands are available on all American Iron Tool Joints. They are applied PRIOR to heat treatment which eliminates chipping, rapid wear and does not affect the physical metallurgy of the tool joint.



2. The "WEDDING BAND": a heat treating process used by AMERICAN IRON, which more than *doubles* the tensile-impact strength of the Flash Welded connection.

3. The REFLECTOSCOPE is a new electronic testing apparatus used by AMERICAN IRON for inspecting the weld zone for inclusions and defects. This assures you of *maximum performance* from your string of Flash Welded Tool Joints.

*Specify Flash Welded OPEN-HOLE Tool Joints for your Lightweight Drill Pipe.*

**AMERICAN IRON**

Another AMF Product PETROLEUM EQUIPMENT

**AMERICAN IRON & MACHINE WORKS COMPANY, INC.**
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

AMERICAN IRON & MACHINE WORKS CO. INC. A OKLAHOMA CITY

# ▶▶▶ Equipment Men Notes

## Ed R. Koberg named vice prexy

E. R. Koberg

. . . of Byron Jackson Tools, Inc., and will headquarter in London, England, announces Robert Harcus, executive vice president of Byron Jackson Division of Borg-Warner Corp. Koberg previously directed BJ export sales operations from the company's offices in New York City.

At the same time, John Bonner was named export representative and will be responsible for sales operations centering in the company's New York offices.

## Mission Mfg. Co. reorganizing

. . . and realigning its sales facilities and personnel, according to T. R. Fullinwider, vice president of domestic sales. The firm's northern and southern Rocky Mountain territories have been shifted to the western district, headquartered at Los Angeles and managed by C. E. Van Loozen.

A field office for the northern Rocky Mountain area will be maintained at Casper, Wyo., and headed by Harvey E. Durham. Durham previously worked for J&L Supply, Harbison-Fischer, and an independent mud company. The southern Rocky Mountain region office will remain in Denver and will be managed by Henry Lee, transferred to that area from the West Texas-New Mexico district office in Odessa. Lee has been with Mission 5 years, joining as an industrial equipment salesman in Houston.

The Panhandle area has been incorporated in the Mid-Continent district with headquarters at Tulsa, under the direction of John Brown. Leon Couch, former sales representative at Oklahoma City, has been reassigned to the Pampa, Tex. office, succeeding A. D. Pritchard who has been shifted to New Orleans as a special sales representative, valve division.

G. B. (Sonny) Wyatt has been moved to Houston from Houma, La., to assume duties as special sales representative, valve division. Anthony Volotko, sales representative, goes from the Houston area to Odessa. Joe Weaver is now in Midland as special sales representative, valve division. He formerly was located in Andrews, Tex. Both Weaver and Volotko will operate under the West Texas-New Mexico district, headed by Manager John Bannister.

## John W. Johnson is transferred

. . . from Michigan City, Ind. to Dallas, by Joy Mfg. Co., to become manager of the oilfield compressor sales department. Previously Johnson was leader of process and chemical application in Joy's reciprocating compressor product department.

## Ben F. Kelly returns to Tulsa

. . . after a complete tour of drilling installations on the Kenai Peninsula of Alaska. Kelly, president of Ben F. Kelly Co., Inc., Tulsa, was particularly interested in inspecting his firm's catheads and tongs on rigs now running in Alaska, and in the installation of KelCo power slips.

Kelly traveled to the four rigs now operating on Kenai by single-motor pontoon planes.

**MODERN-DAY DESERT SHIP** is this giant tractor-trailer combination, one of two delivered recently to Hunt International Petroleum Co. for duty in Libyan deserts. Both truck-tractor—a Kenworth 953—and Hobbs trailer are specially built for desert-type operation, where unusually large super-flotation tires are needed. The Hobbs float has a fabricated centerbeam 21-in. deep, constructed of high-strength steel, which enables the trailer to carry net payloads of 100,000 lb. or more. This load can be either "tail-boarded" onto the trailer over the rolling tailpipe or winched up from the front when the trailer's nose is let down to the ground.

## Union Switch & Signal appoints

. . . Robert J. Cook as supervisor of pipeline sales and appoints Daniel N. Rowswell, Jr. as sales engineer, reports T. C. Schroeder, product manager, systems. Union Switch & Signal is a division of Westinghouse Air Brake Co.

R. J. Cook

D. N. Rowswell, Jr.

Cook formerly was area representative for the midwest. He joined the division in 1953 and became sales engineer for pipeline control systems in the general apparatus department 5 years later.

Before beginning with Union Switch & Signal, Rowswell was a petroleum engineer for Standard Vacuum Oil Co. for 2 years. He also served as a project engineer in Sumatra, Indonesia, for the company for a year. Most recently Rowswell was a project engineer for Koppers Co.

## Carl B. Arnold assumes position

. . . as pipeline contractor representative, working out of the Dallas office, for Browning-Ferris Machinery Co. The report comes from J. Fred Forster, sales manager.

C. B. Arnold

For the past 3½ years Arnold was a territorial salesman for Browning-Ferris. Previously he worked for Magnolia Pipe Line Co. as a pipeline contractor.

## George L. Flint becomes

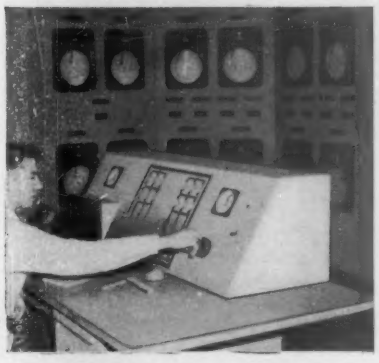
. . . product development engineer for Lone Star Steel Co., according to Executive Vice President W. H. Johnson. Flint will be responsible to L. G. Graper, vice president, operations, research, and development; and will coordinate product diversification with Walter T. Moreland, vice president of sales.

## McGaffey-Taylor Corp. acquired

. . . by Eastman Oil Well Survey Co. through exchange of an undisclosed amount of stock.

McGaffey-Taylor, with sales-serv-

# AUTOMATION ECONOMY



# FOR YOUR SYSTEM

American® telemetering and telecounting equipment helps one man do the work of many ...in gathering fields, transmission and distribution systems.

*One man* at a central dispatching station instantly receives accurate flow and pressure readings from remote points and adjusts for demand with remote-set controllers.

For further information consult your American representative.

American Telecounters accurately transmit Base Volume Index indications of gas quantities computed to base temperature and base pressure conditions, to central locations.

AMERICAN® METER COMPANY
INCORPORATED (ESTABLISHED 1836)
General Offices: Philadelphia 16, Pa.
Sales Offices in Principal Cities


ice offices in Long Beach, Ventura, Bakersfield, and Avenal, Calif., is a 28-year-old company specializing in oil-well squeeze, washing, and cementing tools. The company designs and manufactures down-hole tools and maintains crews to service drilling rigs and redrilling of existing wells throughout California.

Eastman, with headquarters in Denver, maintains regional offices in Long Beach, Houston, Lafayette, La., Casper, Wyo., Oklahoma City, and Odessa, Tex.

## Cummins Engine Co., Inc. names

...C. R. Boll to the new position of executive vice president of marketing; R. W. Franck to vice president of sales; and Reece Hatchitt to the newly created post of vice president of international operations. During his 14 years with Cummins, Boll has served as sales engineer, assistant regional manager, manager of engine sales, general sales manager, and vice president of sales.

C. R. Boll

Franck joined the company in 1948

R. W. Franck

Reese Hatchitt

as a market research analyst and has also served as manager of warranty administration and as manager of sales development. In 1959 he was advanced to director of field sales.

Hatchitt joined Cummins 2 years ago as director of international operations. Previous assignments have been largely in international operations, including resident assignments in Europe and in South America.

## J&L Supply Division reassigns

...five members of its field sales force, announces W. L. Wolfe, vice president in charge of sales.

W. C. Blackledge, salesman at Laurel, Miss., is assigned to Natchez, Miss.; N. W. Babb, formerly at New Orleans, goes to Harvey, La.; L. K. Meredith shifts from Bushton, Kans. to Lindsay, Okla.; H. D. Witt, previously at El Dorado, Kans., has been sent to McCook, Neb.; and J. B. Oujesky, sales trainee at Lafayette, La., has been promoted to salesman and will remain at Lafayette.

## R. L. Hanes is general manager

...of tubular sales of Colorado Fuel & Iron Corp., according to F. S. Jones, vice president in charge of sales. Hanes has been with CF&I for 31 years. He has been in sales for 25 years, and most recently was assistant to the vice president of sales.

Previously he served as district sales manager at Houston and Fort Worth; manager of warehouse sales at the general offices in Denver; and as manager of wire and rolled product sales. During 1951 and 1952 he was in charge of the Washington, D. C. offices.

## Kern County Land Co. reports

...the formation of Gas Processors, Inc., as a new subsidiary. The firm designs and produces portable, skid-mounted, gas-treating units that remove liquids from natural gas on the lease. Kern County Land owns 80% of the new corporation.

President of the subsidiary is Ralph T. Thompson. Vice presidents are Raymond J. Hull, Robert C. Gentry, Walter Moody, and John A. Tiehen.

## F. J. O'Donnell is appointed

...sales representative for Wolverine Tube Division of Calumet & Hecla, Inc., announces T. F. Vigmostad, sales manager of the New York district.

O'Donnell formerly was associated with United Wire & Supply Co. His sales activity will be focused on Wolverine's copper, copper alloy, and aluminum tube and extruded aluminum shapes.

## Equipment Engineers, Inc. adds

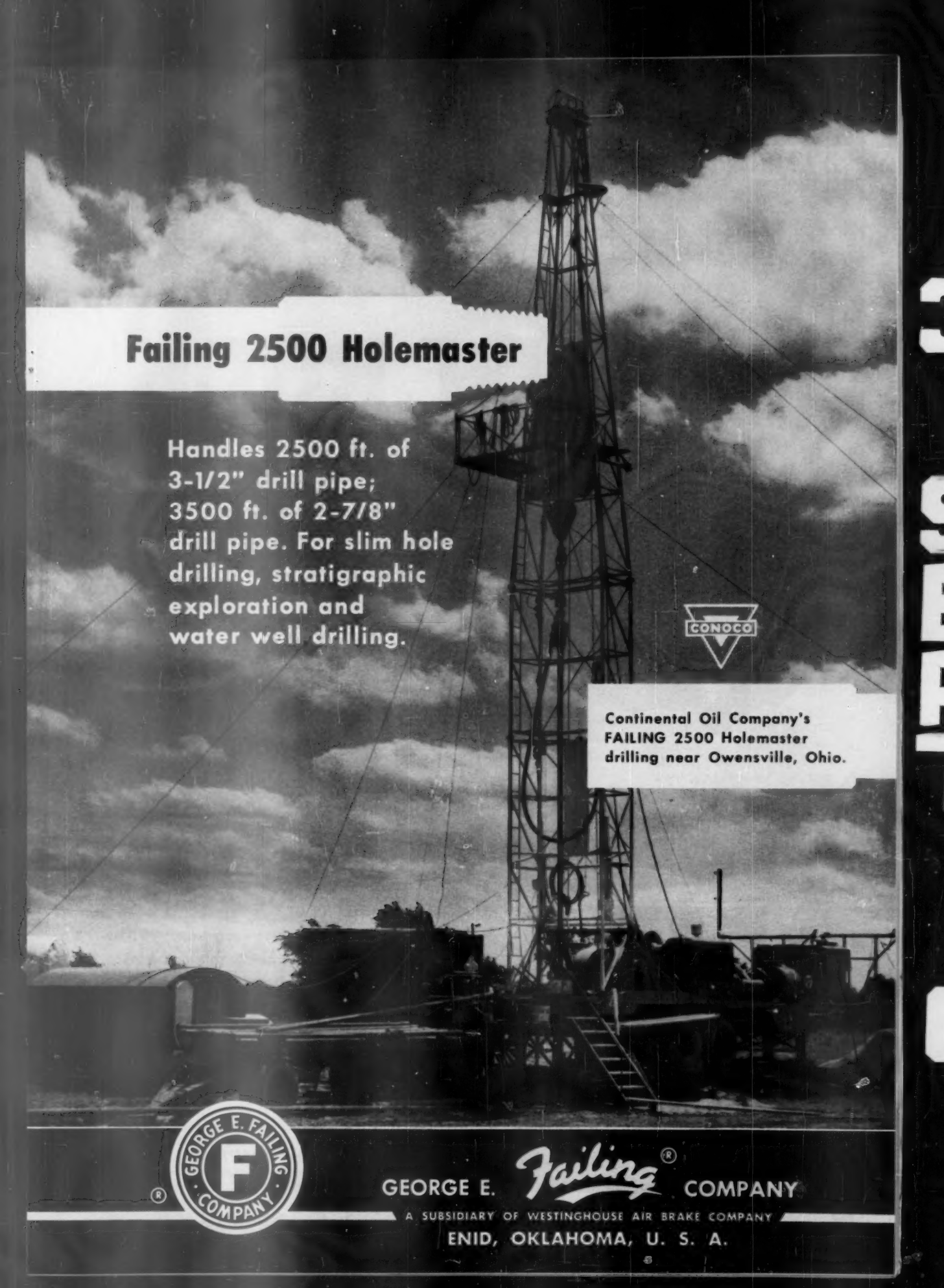
...Karl L. Berry to its sales staff and Shelby J. Graves to its engineering department. Berry joins the

K. L. Berry

S. J. Graves

Dallas-based firm after 25 years of service with an oil company. He now will travel throughout the country as a sales representative.

Graves became chief engineer after joining Equipment Engineers earlier this year. Previously he was a test engineer and later was in the research and development department of Otis Engineering Corp.


Failing 2500 Holemaster
Handles 2500 ft. of 3-1/2" drill pipe; 3500 ft. of 2-7/8" drill pipe. For slim hole drilling, stratigraphic exploration and water well drilling.
CONOCO
Continental Oil Company's FAILING 2500 Holemaster drilling near Owensville, Ohio.
GEORGE E. FAILING COMPANY
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A SUBSIDIARY OF WESTINGHOUSE AIR BRAKE COMPANY
ENID, OKLAHOMA, U. S. A.

Smith

# TYPE DT ROCK BITS

## FOR SOFT FORMATIONS

The **SMITH TYPE DT** 3-cutter rock bit is designed and constructed to insure rapid rates of penetration in moderately soft to soft formations... sturdy, deeply cut and widely-spaced teeth... optimum self-cleaning properties are provided by the widely-spaced teeth in combination with ample tooth deletions and efficient flushing action of the circulating fluid.

Smith
TOOL CO.
COMPTON, CALIFORNIA
Branches in Principal Oil Centers
Throughout the World

*WRITE TODAY FOR OUR NEW BIT COMPARISON CHART*

DRILLING RECORDER is used for first time on this South Louisiana rig. TOTCO model shown is on Rowan Drilling Co. Rig. 4.

Recorder is . . .

# Mechanical-hydraulic tool

A NEW MODEL TOOL is being run for the first time in South Louisiana on Rig 4 of Rowan Drilling Co., Fort Worth.

It is a drilling recorder made by Technical Oil Tool Corp., Los Angeles. Designed initially as an integral rig accessory, the machine charts three variables simultaneously: rate of penetration, drill-string weight, and torque.

Mechanically, it tells time elapsed for each foot of hole drilled, number of feet drilled per hour, total depth, formation changes, and classifies drilling and nondrilling times. Hydraulically, it tells total weight on drill string in suspension, weight on bottom, and changes in weight.

Torque factor is also hydraulically measured to obtain tight spots in the hole and will indicate locked cones. Shown next to the tool is R. D. Hayes, Jr., Rowan toolpusher. Well site is Arkansas Fuel Oil Co. 1 Placide Hernandez in the Vatican field of Lafayette Parish. Contract depth is 11,500 ft.

## New firm formed

FORMATION of a firm specializing in air-drilling services and equipment on the international scene, has been announced by president of the new company, C. V. Helm.

The firm, International Air Drilling Co. (INTAIRDRIL) has general offices at 2509 Berry in Fort Worth. European headquarters are at 47 Avenue de Floreal in Brussels, Belgium. The company will specialize in providing a fully integrated air-drilling serv-

SCALE PROBLEMS?

INHIBITED ACID

Bulk Inhibited Hydrochloric Acid has many uses to help solve both maintenance and production problems. For instance, Dowell Inhibited Acid is useful for cleaning scale and gyp from producing formation, tubing and lead lines; cleaning scale from piping, valves, fittings and nipples; dump-job treatments in old dolomite or limestone wells. Particularly suited to do-it-yourself treatments. Available in bulk lots at all Dowell stations. Economical.

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

DIAL DOWELL

## HOLDS LOAD "RIGHT THERE"

# SMOOTHER THAN STEAM

## DRILLED OVER 22,000 HOURS AND STILL GOING STRONG

Run a torque converter on a drilling rig for over 22,000 hours without laying a wrench on it and your profits are bound to look good. Right?

You can bet they will – for you'll not only save money on repairs, but on lost drilling time too.

And that's exactly what Crow Greyhound Drilling Company of Shreveport, La., is doing by using TORQMATIC Converters on three of its drilling rigs. The converters on one rig have racked up more than 22,000 hours of trouble-free service. In all that time, *the only thing Crow Greyhound Drilling Co. did to the converters was normal preventative maintenance.*

But it's not just TORQMATIC's trouble-free performance that's saving money for Crow Greyhound Drilling Co. They're also drilling faster, making faster round trips, spending less on rig maintenance because of the "smoother than steam" power transmission. Inch-by-inch control saves time on fishing jobs—and drill strings last longer with TORQMATIC absorbing the shocks.

You can make more – save more – with TORQMATIC DRIVES working for you on your drilling, fracturing, or servicing jobs. They're available from most leading oil field equipment manufacturers. See your dealer for details, or write Allison Division, General Motors, Indianapolis 6, Indiana. In Canada: General Motors Diesel Limited, London, Ontario.

Allison

TORQMATIC® DRIVES

*THE MODERN DRIVE FOR MODERN EQUIPMENT*

ice to oil companies operating overseas, according to Helm.

Helm formerly was assistant to the executive vice president of Western Co. He had been with Western since 1948, in various capacities ranging from engineer to division manager. A graduate of Dartmouth College with a bachelor of science degree, Helm received a master of science degree from MIT in 1958. Before joining Western he was a petroleum engineer with Stanolind Oil & Gas Co.

Vice president of the new firm is William A. Triest, a veteran air-drilling specialist who was formerly with Gardner-Denver Co. Triest is a native of Belgium with broad experience in foreign-oil operations, specializing in engineering, equipment design, fabrication, and sales and service of air-drilling equipment.

## Active Rigs*

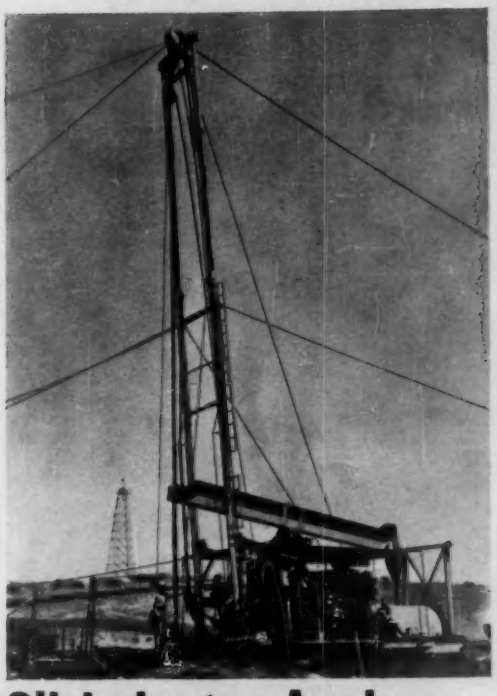
| | Rotary | Cable | Total† |
|---|---|---|---|
| Alabama | 5 | 0 | 5 |
| Alaska | 7 | 0 | 7 |
| Arizona | 1 | 2 | 3 |
| Arkansas, South | 24 | 0 | 24 |
| California, Offshore | 5 | 0 | 5 |
| Inland | 120 | 1 | 121 |
| Colo., excl. Four Corners | 28 | 4 | 32 |
| Four Corners | 10 | 1 | 11 |
| Florida | 2 | 0 | 2 |
| Georgia | 3 | 0 | 3 |
| Idaho | 1 | 0 | 1 |
| Illinois | 43 | 8 | 51 |
| Indiana | 12 | 28 | 40 |
| Iowa | 1 | 0 | 1 |
| Kansas, western | 80 | 1 | 81 |
| Kentucky, western | 9 | 38 | 47 |
| Louisiana, North | 75 | 0 | 75 |
| South Inland | 212 | 0 | 212 |
| Offshore | 68 | 0 | 68 |
| Michigan | 34 | 37 | 71 |
| Mississippi | 50 | 0 | 50 |
| Missouri | 0 | 0 | 0 |
| Nebraska, East | 0 | 0 | 0 |
| West | 21 | 0 | 21 |
| Nevada | 5 | 1 | 6 |
| New Mexico, East | 79 | 28 | 107 |
| West | 42 | 5 | 47 |
| North Dakota | 17 | 0 | 17 |
| Ohio | 4 | 120 | 124 |
| Oregon | 1 | 0 | 1 |
| Pennsylvania, North and Middle | 0 | 57 | 57 |
| South Dakota | 2 | 1 | 3 |
| Texas, Offshore | 1 | 0 | 1 |
| East | 63 | 0 | 63 |
| Upper Gulf Coast | 96 | 0 | 96 |
| North | 111 | 1 | 112 |
| Panhandle | 44 | 8 | 52 |
| Corpus Christi | 103 | 0 | 103 |
| San Antonio | 40 | 5 | 45 |
| West | 215 | 14 | 229 |
| West Central | 83 | 27 | 110 |
| Utah, North | 9 | 0 | 9 |
| South | 14 | 0 | 14 |
| Washington | 2 | 0 | 2 |
| West Virginia | 5 | 227 | 232 |
| Wyoming | 72 | 3 | 75 |
| **Reported U. S. Total** | **1,819** | **617** | **2,436** |

*Report to AAODC by the International Oil Scouts Association.

†As of September 9, 1960.

Not reported: Arkansas, North; Kansas, eastern; Louisiana, Southwest; Montana; New York; Oklahoma; Pennsylvania, South; and Tennessee.


Guy your DRILLING or SERVICING Equipment *QUICKLY... SAFELY... SURELY...* with CHANCE Oil Industry Anchors



**CHANCE SCREW ANCHORS**

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Where anchor holes can be readily drilled with machine or post hole auger you can get excellent, permanent guying with this 8-way expanding anchor. The Chance 8-way is dropped into the hole and expanded into solid earth by an expanding bar delivering pile-driver-like blows on the top of the anchor. Many users install them to support drilling equipment and leave them in place to guy servicing rigs. Chance 8-ways hold up to 31,000 pounds, depending on anchor size and type of soil.

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Harold Vance, Vice President and Manager, Oil and Gas Department, on location.

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# Iowa may have an oil field

ATTENTION oil finders! Something may be brewing in the Corn State. Reports from Cresco, Iowa, indicate that we may soon see the debut of the nation's thirty-fourth oil state.

As things stand now, it's hard to tell. We find Hans Jespersen a most reluctant oil man. In a telephone interview, he confirmed that he had indeed pumped 45 bbl. of oil in 15 hours from his second wildcat in Howard County, Iowa. He felt that a front-page story in the Cresco, Ia. Times-Plain Dealer had put the well's potential a wee bit high when it credited the discovery with 48 bbl. in 15 hours. Yes, he intends to drill some more wells. No, he has not started to sell his oil, but he will. Yes, he will hire a seismic crew to help outline the field. No, he will not reveal the name of the seismic contractor nor the names of those who have offered to buy his production (three buyers reportedly were after it).

The Iowa State Geological Survey couldn't confirm the discovery as legitimate, but state geologists will look into the matter and issue a press release when and if testing of the well is resumed.

Jespersen started his drilling program on the George Niewald farm, 10 miles west of Cresco, about a year ago. Last winter he made headlines by reporting a pump test of 49 bbl. daily at the 1 Niewald in Section 31-99n-12w (OGJ, January 25, 1960, p. 135). That well, however, was abandoned after tools stuck in the hole and fishing jobs failed.

Now, the second well, 2 Niewald, Section 31-99n-12w, is having pump trouble. Jespersen commutes to the drilling site from Omaha, and he's expected to return to Cresco very soon to put things right at the new discovery. Reporters from the Cresco newspaper were invited to witness the testing of the well; they watched the tank gaging but not the actual pumping. Jespersen says the pump now has broken down.

**REPORTS** of oil at an Iowa wildcat have been confirmed by the operator. If put on steady production, this will be the first oil well in the state.

An earlier well on the Niewald farm was drilled by F. H. Hunt. It is reported to have seeped oil into the hole, but not enough to prevent abandonment. Jespersen credits observations from gamma-ray logs of wells in the vicinity with the success at the second Niewald test.

There are two zones of production, according to the operator. One is in the Devonian at 420 ft., and the other in the Ordovician at 872 ft. Gravity of the oil is estimated at 38°.

Two more cable-tool wells are planned for the area, according to Jespersen. These are expected to be staked soon. Meanwhile, timing equipment will be installed at the discovery to allow 12 hours per day of pumping time. Jespersen is vice president of Saratoga Development Corp. and president of H. & L. Oil Co. of Omaha.

So when we see those transports trucking oil from the Niewald farm to Chicago or Des Moines, we'll welcome Iowa to the oil-producing column. Until then, all we know is what we read in the newspapers.

**WILDCATTER** Hans Jesperson poses for what may be an historic picture, as these are the first oil-field tanks to rise from the Iowa plain.

*How One Operator used D-Gassers to*

# reduce gas well costs by about $55,000

A Canadian operator — drilling deep gas wells in the Alberta foothills — is using the SWACO D-Gasser to save about $55,000 per well. Here is how he does it:

This operator, who was developing a gas field in the Alberta foothills, was encountering a gas-cutting problem during drilling that increased costs seriously. The problem was high-pressure, low-volume gas accumulations in a shale section above the main pay or between pay zones.

Until this shale section was reached, mud weight of 10 pounds per gallon was carried. When this section was being penetrated, however, severe gas cutting and "blowing" occurred. The gas cutting then persisted in the form of a two to three hour trip gas for the remainder of the well.

**Practice before using D-Gasser**

The operator circulated until he could build mud weight up to 11-13 pounds per gallon to control the gas cutting. Lost circulation in the pay section frequently occurred with the heavy mud, and a great deal of lost circulation material was often required. The cost of mud materials to control both gas and lost circulation ran $25,000 or more per well.

Initially, it took anywhere from two days to a week to condition the mud, and in one case it was necessary to set casing before drilling could proceed. In addition, several hours of rig time were lost after each trip gunning out the trip gas.

**Practice when using D-Gasser**

With a D-Gasser installed, the operator merely starts it up when the gas cutting occurs. Occasionally the preventers have to be closed, and the well placed on choke for a few hours. However, the whole job of mud conditioning can be accomplished in less than one day without increasing the mud weight. Moreover, penetration rates and bit life while drilling using the lower weight muds are substantially improved. Total savings in drilling costs amount to approximately $30,000 per well.

To summarize, the operator has found he saves $25,000 or more in mud costs and something like $30,000 in rig time and other drilling costs.

This case is just one of many examples that prove the SWACO D-Gasser is more than just a safety device to be used for wildcat drilling. It makes possible important reductions in overall well costs in any area where gas cutting is a problem. Contact your nearest SWACO representative to find out just how much D-Gassers can reduce your costs. Also ask him how SWACO Clayjectors and D-Sanders can further reduce drilling costs.

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A new trend in exploration is . . .

# Geophysical data for trade and sale

**Seismic exchange centers have sprung up in the past few years and are providing a much-needed service. Here's where they are and how they operate.**

BY PETER B. BIKE
Geophysical Editor

A NEW exploration concept has been developed. This thriving infant is the geophysical exchange, service, or library, and it looks now as if the exploration off-spring has an excellent future.

During the mid-fifties the first library was put into operation and has continually grown. Started initially as a source of seismic data for sale or trade, the central exchange has expanded into gravity and magnetic data coverage. Today there are at least five other firms doing essentially the same service, yet for all practical purposes there is relatively little overlap of data.

The location of each firm's offices does not necessarily indicate the geophysical data that it handles. A Dallas exchange has coverage in Ohio, Illinois, and Alberta. A Calgary trade center has negotiated trades on prospects in California, West Texas, and the Northwest Territories. The possible exception is a New Orleans exchange that stays pretty much in its own bailiwick and specializes in Louisiana, Mississippi, and the gulf offshore; but don't be surprised if one of its member companies offers to trade a prospect in Alaska for an offshore area next year.

**Purpose of the data center.** Trading geophysical data among the operating oil firms is old hat, and has been going on for years. Of late there has been some resistance between some of the operators to trade outright because of the increased feeling that the competing firms were "looking in their pockets" during the involved negotiations of a trade. Usually you have to show what and where, when you're trading directly, and it can make one uneasy. The central data exchange can do the trading on an efficient, anonymous, and impersonal basis.

Furthermore, the price is right. Although terms and conditions of the libraries vary somewhat, the price schedules are substantially lower than new shooting would cost. It might appear, therefore, that geophysical contractors are going to suffer as the result of record exchanges. On the contrary, a major company a few years ago, traded nearly 3,000 records through an exchange. As a result of leads which were developed by reanalysis of trade records, one crew was kept busy for a year doing additional work checking the initial leads. Eventually several wells were drilled and a couple were new-pool openers. The traded data and subsequent shooting paid for itself multifold. Without the trade data, the new shooting would probably never have been done.

**How the exchange centers operate.** Terms and conditions of the exchange libraries vary somewhat, but overall procedure is generally similar. Details of each center are discussed later. Some exchanges are strictly on a membership basis. To participate, a member must contribute a set of records. If 100 records are contributed, this firm may then withdraw the same number of profiles at a set cost per profile. This method is in essence a clearing-house trade operation. One modification of the clearing house is direct two, three, or four-way trades where the operating companies are unknown to each other.

Some of the trade centers have records for sale. The cost will depend on the area and the quality of the coverage and prices are available upon request.

One firm classifies its records into two groups: trade exchange and deposit exchange. Trade-exchange records are available only by selective trade arrangements on a mutual-agreement basis. The library acts as intermediary in this exchange. Deposit exchange data are immediately available for withdrawal by qualified member firms. In either type of exchange, the center maintains a credit and debit shot-point balance account for each participant.

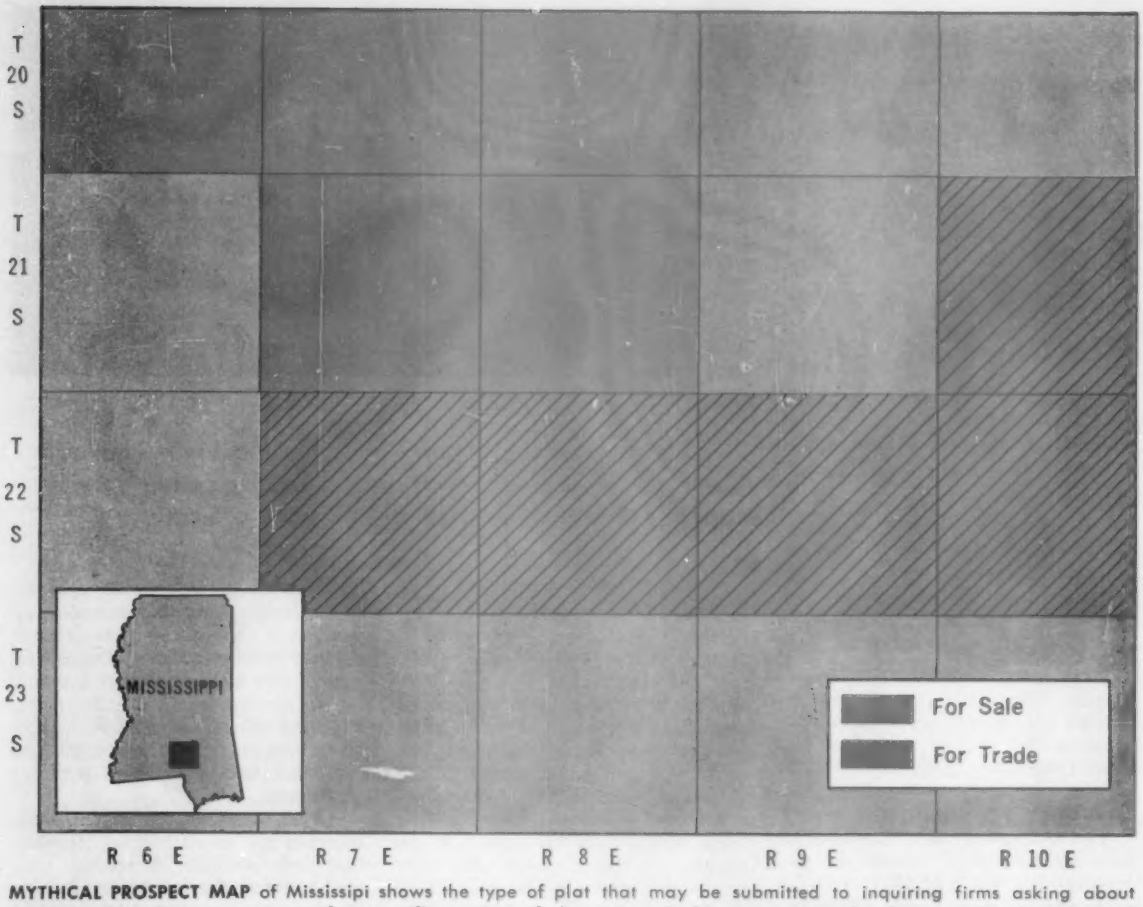
All of the trade centers encourage inquiries on specific areas. Suppose that your company is seeking trade data in South Texas, say in Refugio County, to supplement some work you've done in the past. Not only are you likely to find records available to you through trade, or possibly sale, but you can also obtain that information on an equitable basis without even having your interest or identity known, by working through the center. Occasionally, you can get this information quicker and cheaper than if you decided to shoot it, assuming you can get the coverage you want.

Small operating firms can obtain records through the center and have them interpreted. This constitutes a saving in overhead and can provide some good reserve prospects.

Here's a rundown on the trade centers now operating:

**Calgary.** This is the only Canadian city now represented with a seismic exchange, Exploration Data Exchange, Ltd., managed presently by David G. Ferguson, vice president. Its address is 334-A Fourth Avenue, SE. Ambitious expansion plans indicate the fine acceptance this center has had.

This company specialized in direct contact with operating firms desiring trades. The data exchange seeks mutual agreement of all interested parties and has completed complex anony-




**MYTHICAL PROSPECT MAP** of Mississipi shows the type of plat that may be submitted to inquiring firms asking about geophysical exchange coverage of a specific portion of the state. Exchange centers also have regional maps and catalogues to show the data they have or can obtain by trade.

mous nine-way trades. It has transacted barters in Alberta, Alaska, Yukon, Saskatchewan, Northwest Territories, British Columbia, and Manitoba. Costs are on a shot-point rate.

Gravity and magnetic data are also available. Services include the usual facilities and inquiries are invited on particular areas of interest. Expansion plans include the opening of an office in London with the ultimate objective of engaging in trades in overseas areas. Trades have already been completed in some foreign countries.

**Casper.** Geophysical Library Co. is managed by Richard L. Billings and William L. Holloway who use P. O. Box 2353 as their mailing address. Actually, the offices are in the POMCO Building at 309 North McKinley.

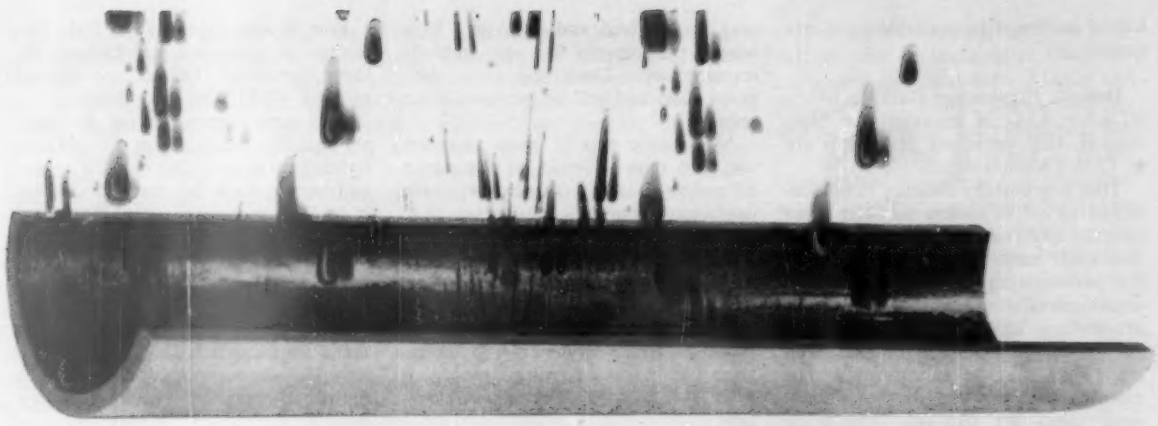
This is a membership arrangement where the trade records are divided into two groups: trade-exchange and deposit-exchange coverage. Trade-exchange records are available by selective trade agreements of a mutual-agreement basis. The center acts as intermediary in arranging the exchange of data between interested parties. Charge for trade exchange is $1 per shot point, plus printing costs. Deposit exchange is available for immediate withdrawal by qualified members of the library. Price for noncharter members is $1 per deposit-exchange record, which includes printing costs. To become a member, a minimum of 100 shot-point profiles are deposited in the library. There is no deposit charge. In either type of exchange, the library maintains a credit and debit shot-point balance account for each participant.

Coverage includes 12 states, primarily in the Rocky Mountain area, and 2 provinces in Canada. There are: Montana, North Dakota, South Dakota, Idaho, Wyoming, Nebraska, Nevada, Utah, Colorado, Kansas, Arizona, New Mexico, Alberta, and Saskatchewan. Other services include a review and consulting staff of experienced personnel, and storage facilities for records. Records may be inspected before withdrawal in the library. An ever-growing regional map of current coverage is available upon request.

**Dallas.** Seismogram Library Corp., is headed by Morris G, Spencer, president; its offices are at 2000 Republic National Bank Building. This is the originator of the seismic library. Approximately 500,000 records are available.

This is a membership clearing-house trade center where the member firms contribute records to the center. They may then withdraw other profiles in areas in which they are interested. No charge is made for contribution, but upon withdrawal a nominal charge of $3 per profile is made.

Coverage presently is a 15-state area and a province in Canada. This is comprised of: Arkansas, Colorado, Illinois, Kansas, Louisiana, Mississippi, Montana, Nebraska, New Mexico, North Dakota, Ohio, Oklahoma, Texas, Utah, Wyoming, and Alberta. Other services include: laboratory facilities for reproduction, including microfilming; and personnel for seismic reviews, or consultation. A cata-



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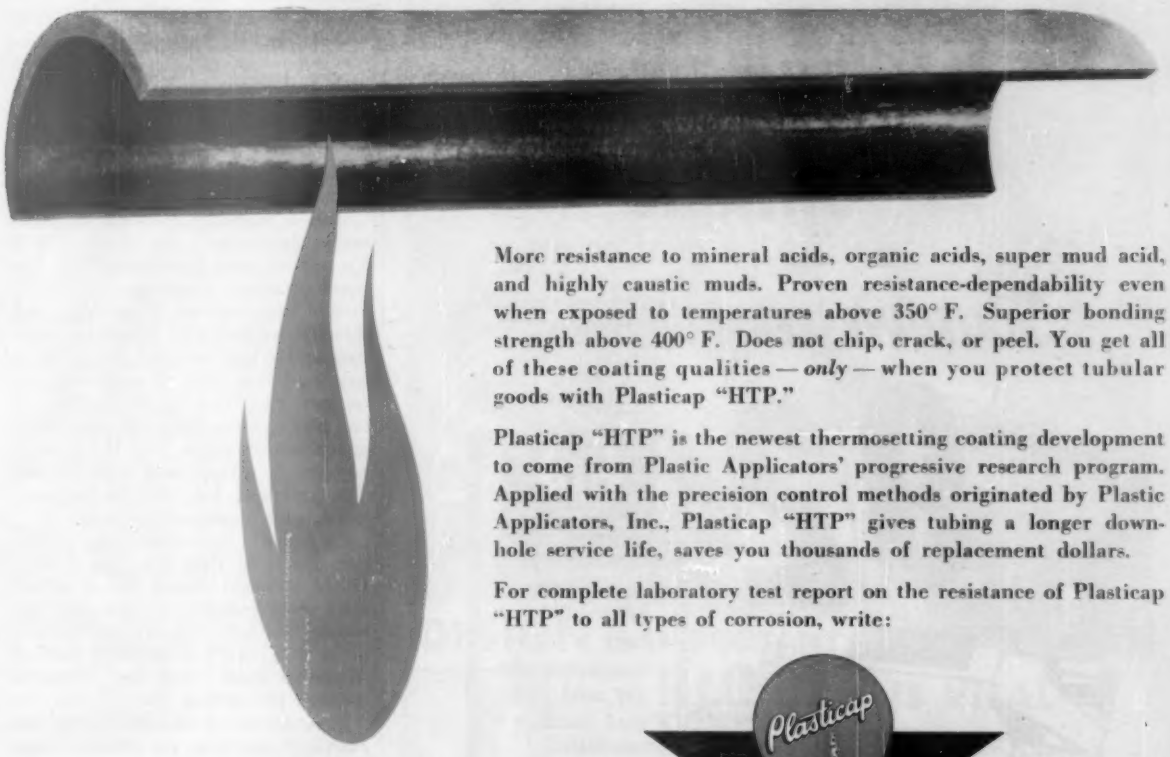

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**Denver.** Exploration Data Exchange (U.S.A.), Ltd., is managed by Norman H. Hill, president. Its offices are at 1726 Champa Street.

This is a custom clearing house designed to act as liaison between firms desiring information on a certain area. The trade may be completed without the participating parties knowing the identities of those with whom they are dealing. This is the case with most of the exchanges when desired. The trade data may be as current as last month's shooting and duplicate magnetic tapes are run off. The trade may be involved and ultimately have several participants that are mutually in agreement. Costs are on a shotpoint basis and will be provided upon request.

No specific area is given as coverage, but data in most of the active oil provinces in the country have been negotiated. Inquiries are invited as to which regions or prospect areas operating firms would like to trade in. Maps are available.

Tentative plans call for opening offices in Bakersfield, Calif., and in Houston, which evidences the acceptance that trade centers are enjoying. This is affiliated with the Calgary firm.

**Fort Worth.** Geophysical Data Exchange is managed by Richard H. Dana, president. Offices are located at 1301 W. T. Waggoner Building.

This is a clearing house for geophysical data available for trade. Trade rights remain with the original owner and until a trade is arranged no data is sent to the exchange. All original reproductions are returned to the owner. The costs are $2 per record traded, plus reproduction charges.

Coverage is currently available in Texas and Oklahoma. In some areas there are records for sale. Other services include: seismic reviews by experienced personnel, gravity and magnetic data, facilities for making record sections, and a microfilm service.

A coverage map is available upon request and inquiries are invited on coverage desired for specific areas of interest. Tentative plans call for expansion of coverage in the Gulf Coast, Mid-Continent, West Texas-New Mexico, and Rocky Mountain areas, which shows a good growth potential.

**New Orleans.** Geophysical Trade Service with offices in the Liberty Building, 315 St. Charles Avenue, is headed by S. G. Taylor, president. This firm is expanding rapidly and specializes in custom trades.

This is primarily a broker arrangement, like some of the others, where the service acts as intermediary between traders. Coverage is mostly limited to Louisiana, Mississippi, and the offshore gulf area. However, negotiations for any area are likely. In its clearing-house type of operation, no records ever leave the office of the participating firms. Reproduction equipment is taken into the trading company's offices and microfilmed. The exchange fees are $2 per shot point, plus reproduction costs.

In addition to seismic data, gravity and magnetic data are also traded. Other services offered are a review staff, record-section facilities, and consulting services. Inquiry on specific areas is invited and selective plats of available trade data are available through the service.

It is interesting to note that all the exchange, services, or libraries cater to custom trading and stress tight security. The latter is imperative. The mode of operation is generally the same for all.

Some operating firms eagerly seek trade data so that they can have a reserve backlog of information in case a new play starts. Its relatively inexpensive protection could prove valuable later.

Resistance to releasing geophysical data among geophysicists and management is melting. Purely monetary consideration of geophysical exploration


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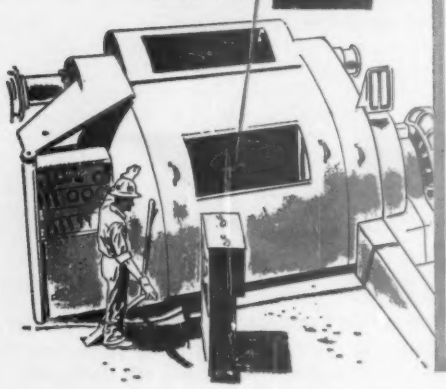

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is no longer a valid excuse. After all, geologists and production people have released electric logs immediately upon completion of some of the world's deepest tests, which have cost hundreds of thousands of dollars each. It just doesn't make good sense to hold out on a geophysical survey that cost thousands of dollars when it has an equivalent value in trade. After all, an electric log of a half-million-dollar dry hole may quite often have little or no trade value.

Geophysical trade centers will never replace current field crews, nor is it intended that they should. Actually, traded data are a boon to the exploration industry because they will usually result in causing more work to be done.

How many times has a prospect been shot when the initial lead was erroneous and work developed in a direction exactly opposite to that originally anticipated? The same often holds true for a trade area. It is quite possible that the areas of interest will shift to the edge of existing coverage and more work is necessary to check it out.

There are some oil companies that do not participate in trade because they feel that their data are superior to the work of others, and that they will maintain a competitive advantage by refusing to release this information. It is unlikely that these mavericks will ever propose to trade, despite potential economic advantages of trading.

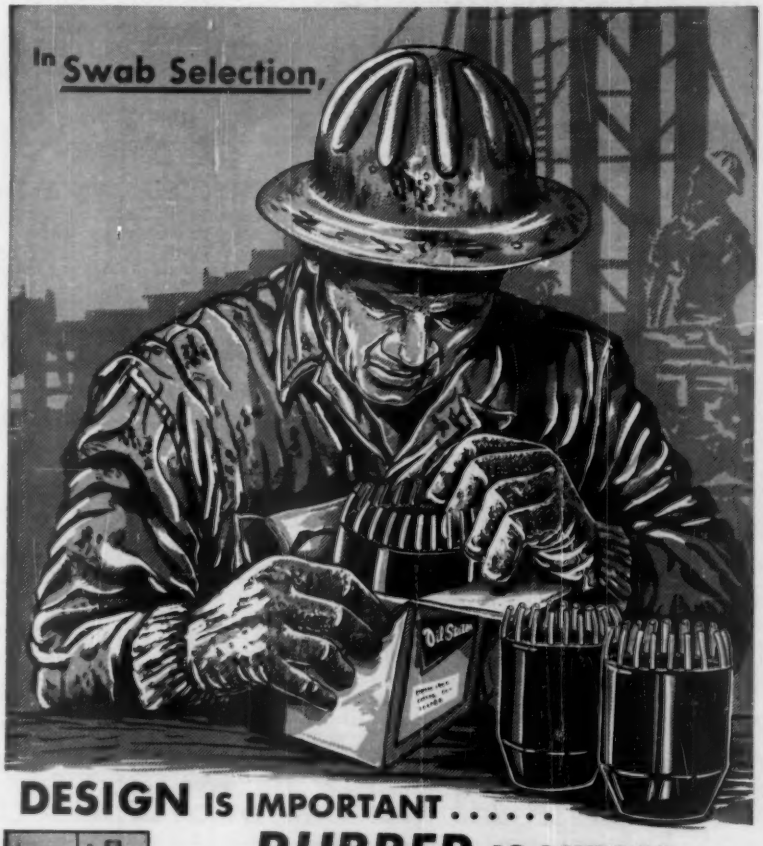
One philosophy that is prevalent in exploration is that all seismic records, or other geophysical data, should be reviewed after they are, say, 10 years old. For some operating firms, this age period may be as young as 5 years or as old as 15 years. In any event the idea is the same. If the records are not reviewed, for one reason or another, then they are traded. However, not only old records are traded.

**Outlook.** The outlook is that geophysical activity will be enhanced, not hampered by data trading. Old records may give the key to shooting a difficut area. Techniques for improving record quality may be noted. In a specific area of unusually difficult near-surface conditions, old profiles can prove that high-record quality is possible, and that procedures used there may be applicable to another geographical spot of similar conditions.

The ultimate hope in trade data is that a good drillable prospect will result. Reanalyses of 10 or 15-year-old records may give a new lead. The human element in interpretation is ever present. What may have been a drillable area 10 years ago may not have been recommended because of leasehold position at that time, a management policy, or budget limitations. Since then, conditions may have greatly improved. Open acreage may now be available, there may be, additional subsurface data, or any combination of conditions may make this a prime prospect worthy of new evaluation.

No area can be fully condemned until as much as possible is known about it. Reevaluation may bring a new concept on a complex area. Gravity and magnetics used in conjunction with seismic information may present greater insight to the true subsurface picture.

No, current shooting won't be scuttled in favor of trade data. There are too many new frontiers. Alaska and Canada have much virgin territory that may never be fully explored. But why go that far to prove a point? Chances are that there is a great deal more oil to be found right here close to home. Anyone who feels that all the oil have been found in Texas, Illinois, or Wyoming is a dyed-in-the-wool pessimist and is beyond salvation if he dwells on the point that all the giant fields have been found in this country.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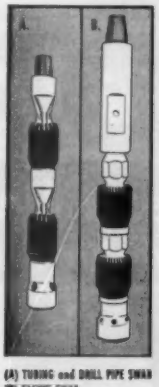


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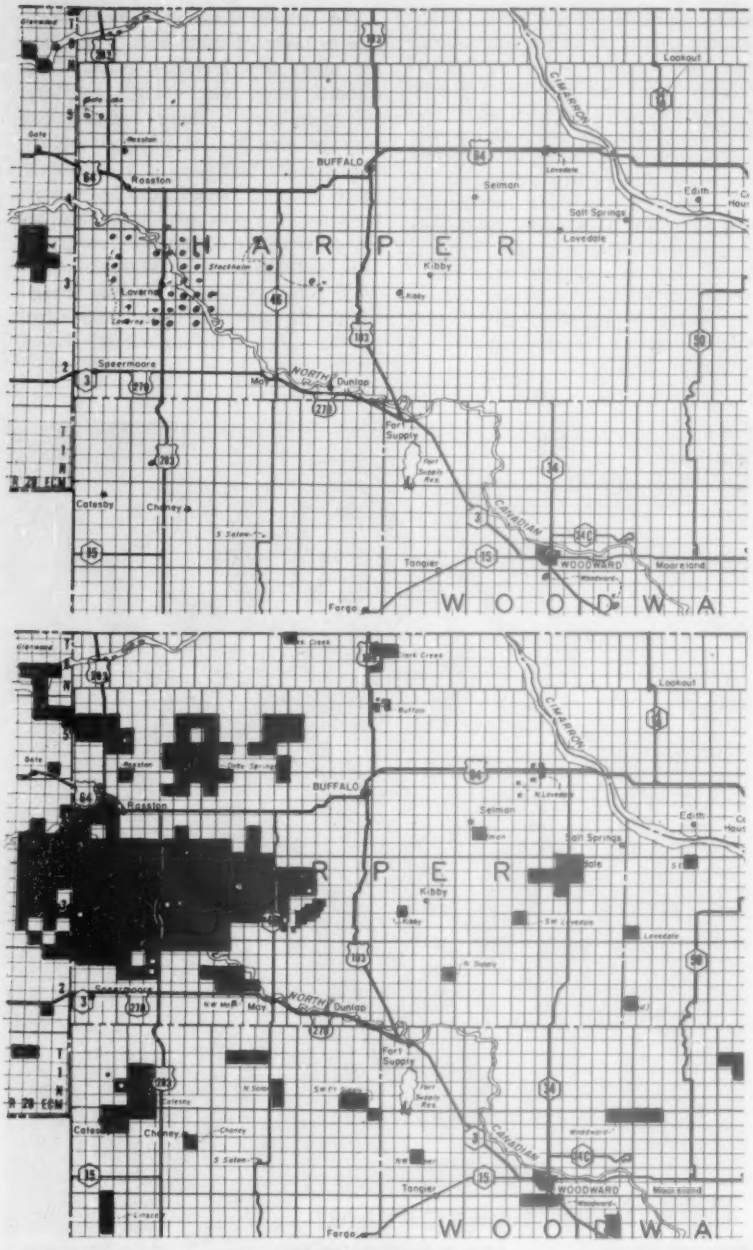






## Map shows growth of northwestern Oklahoma oil scene

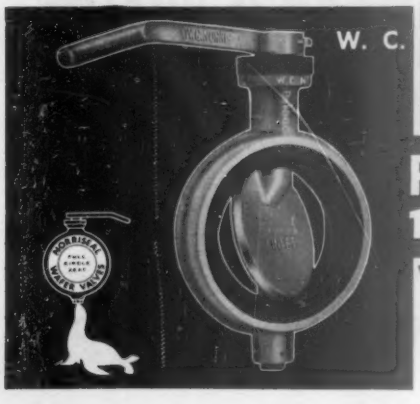
**THIS striking comparison of two sections of Research Oil Reports Oil-Road Atlas of Oklahoma illustrates how northwestern Soonerland has changed oil and gas-wise since 1957. The portion of the state shown on the left includes parts of Beaver, Harper, Woods, Ellis, and Woodward counties as they were in 1957. On the bottom map the noticeable new black areas show why this is one of the most active exploratory areas in the nation today. The new Oil-Road Atlas for 1960 is now available from Research Oil Reports, Kennedy Building, Tulsa, and Commerce Exchange Building, Oklahoma City.**

## Alberta field makes fast growth

AN AREA in northwestern Alberta, 75 miles northwest of Peace River town, is emerging from a potential gas-producing section into a field of major proportion. Shell Oil Co. of Canada, Ltd., opened gas production at Worsley in August 1959. Since then Shell has drilled one dry hole and two gassers.

Last month the company extended the field 6 miles east of the discovery well. This well could have possibly doubled the reserve picture. Following the field's opening, Shell got tight on information. While much is still confidential, enough has been gleaned to show that the area contains more than promise.

The discovery well was drill-stem-tested over a 162-ft. D3 reef section. It flowed condensate-bearing gas at rates up to 8 M.M.c.f.d. Later testing flowed more than 12 M.M.c.f.d., indicated an absolute open-flow potential of over 65 M.M.c.f.d. Charting on those latter evaluations was not con-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clusive and while the 65 M.M.c.f.d. potential was used for reserve calculations, it is understood that the "points" did indicate a potential as high as 1.7 billion cubic feet.

**Stepout test.** The extension test that was drilled 2½ miles east of the discovery well, 10-23 Worsley, did not contain the pressure rating of the discovery. It flowed up to 25 M.M. c.f.d. through tubing and indicated an open-flow potential of 165 M.M.c.f.d.

The newest well, Shell 19-19 Worsley, LSD 10, 19-87-6w6, 6 miles east of the 14-19 strike, and 3 miles east of 10-23, has had production casing set. Shell added to its already substantial acreage holdings around the area by paying large prices for a pair of drilling reservations tracts. Those parcels lie east of the latter well with the closest lands 10 miles east of the field discovery, but only 3½ miles east of 10-19 well. The two tracts that Shell just bought contain about 8,500 acres apiece and lie side by side east of the gas wells. The closest of the two was bought for a bonus of $559,097.95 while the other cost Shell $459,079.95. For each acre contained in the initial tract Shell paid $67.20 and for the other an average price of $52.17.

## Michigan exploration up, but development down

Field development in Michigan is down about 20% from 60 days ago but exploratory work is on the gain as evidenced by 12 wildcat starts out of 20 new state drilling permits.

Outside of scattered offset and fill-in work, most field drilling is centered along the Scipio-Albion trend where another 200 or more locations probably will be drilled eventually.

The original Scipio and Pulaski pools and Homer pool now are practically linked together. However, Homer and Albion still are 2 miles apart. The production chain has a 3-mile gap between Albion and Sheridan and there is an undeveloped area 5 miles long between Sheridan and Lee. It is these open areas that are expected to get the most field drilling action during the months ahead.

Still in the testing stage, Bell and Gault's 1 Young, NE NE NW 11-8s-1w, Wright Township, Hillsdale County, offers the best news on trend prospect in southern Michigan for several months.

The wildcat is located 15 miles southeast of the Scipio-Adams end of the trend. It showed 1,250 ft. of oil natural at 3,466 ft. in the Prairie du Chien, 30 ft. below the base of the Black River section. If commercial it could start a substantial new play. Ohio State line and through the new spread all the way from Scipio to the Ohio state line and through the new area.

## Second stepout from big California well planned

In California's Sacramento Valley, two operators are preparing to move in equipment to drill a second offset to the state's biggest gas well of the year.

Cameron Oil Co. and Franco Western Oil Co. will drill the 1 Wood-Strauble in 4-14n-1e of Sutter County, which is 6,000 ft. northeast of their 1 Helen McLaughlin. The operators are testing a third well, 1 H. L. Sanborn & Sons in 32-15n-1e, which is 8,000 ft. northeast of the deep discovery in Grimes field.

The 1 Helen McLaughlin was completed as a dual producer in the "F" zone. The well had an initial potential of 33 M.M.c.f.d. from six intervals. It is believed to have about 94 ft. of net effective pay from the two completion zones. The upper zone is at 6,924-94 ft. and the lower at about 7,475 ft.

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## Wells tap Tyler sand in Montana's Keg Coulee

Central Montana's Keg Coulee field is growing with big wells being completed in the Tyler sand.

Honolulu Oil Corp. completed 25-13 Stensvad in C SW SW 25-11n-30e, Musselshell County, flowing 650 bbl. of oil per day on 32/64-in. choke from Tyler-C sand perforations at 4,585-4,650 ft. At an east extension to the field Honolulu reported 455 bbl. of oil in 10 hours through ½-in. choke at the 25-15 Stensvad in C SW SE 25-11n-30e. Flow was from Tyler-C through perforations at 4,570-4,620 ft. Testing continues here.

Continental Oil Co. is testing at 1 Butts in NE SE 26-11n-30e. Location was made for 2 Butts in C SW SE 26-11n-30e.

**Definition.** Keg Coulee field was defined to include pools opened by Sumatra Oil Co. and American Climax Petroleum Co., Lawrence Baker, Jr., and Continental Oil Co. On the west side of the producing area where Honolulu is drilling, Sumatra Oil Co. completed the discovery well at 2 Stensvad in C NE NE 35-11n-30e. That well flowed 227 bbl. per day from Tyler-C through perforations at 4,594-4,604 ft. The discovery well on the east side of the pool was American Climax, Barker, and Continental 1 DeJaegher in C SE NE 31-11n-31e. It pumped 177 bbl. per day from Tyler-A sand through perforations at 4,302-16 ft.

## Success mounts in Sooner's Kingfisher

OKLAHOMA'S Kingfisher County exploratory success never seems to wane.

El Paso Natural Gas Co. dually completed its 2 Will A in C NE SE 11-19n-6w, East Hennessey field, flowing 1,310 bbl. of oil daily on 25/64-in. choke from open hole at 6,648-6,744 ft. in the Meramec Mississippian.

This high-flowing well was a dual completion. From Manning the well made 79 bbl. of oil daily on 12/64-in. choke from perforations at 6,451-78 ft.

## Reworking old hole pays in Oklahoma's Major

Deepening an old hole in Major County, northwestern Oklahoma, paid off handsomely for Pan American Petroleum Corp.

The 1 Barnes unit, a wildcat in NE SW 29-23n-15w, originally drilling to 7,286 ft. in 1958, was deepened to 8,293 ft., plugged back to 8,120 ft. and perforated in the Hunton Siluro-Devonian at 8,041-44 ft. The flow was 312 bbl. of oil in 49 hours on 12/64-in. choke. Gas flow was 9,100 M.c.f.d.

Nearest Hunton production, one of the three in the entire Anadarko basin, is at South Campbell field, 5 miles southwest.

## Hunton flows at Major County hit in Oklahoma

Hunton Siluro-Devonian production was tapped in northwestern Oklahoma's Major County. The discovery well is Pan American Petroleum Corp. 1 Barnes Gas Unit in NE SW 29-23n-15w, 5 miles northeast of Hunton pay at West Campbell.

The well was an old one drilled deeper from 7,286 ft. Perforations at 8,041-44 ft. got 312 bbl. of oil in 49 hours through 12/64-in. choke. The well also flowed 9,100 M.c.f.d. This discovery is considered another important link in the sparsely productive Hunton in this part of the state. West Campbell on its discovery 3 years ago was the first Hunton find in this part of Oklahoma and in the Anadarko basin.

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## Second well for new Texas field

The new field that Arnold O. Morgan and Southern Minerals Corp. opened last August in southern Nueces County, lower Texas coast, is showing up as a potentially good discovery.

The second well, just completed by the same operators, not only confirms the field discovery, but adds another pay zone.

Discovery well, 1 Chapman, was completed from a pay at 6,092-93 ft., designated as the Chapman zone. It flowed at the rate of 152 bbl. daily.

The new well, 2 Chapman, 1,320 ft. south, flowed 147 bbl. of oil daily through 8/64-in. choke from the same zone at 6,079-81 ft., and opened a slightly higher zone at 6,070-71 ft. (Upper Chapman sand) with a flow of 149 bbl. daily through 9/64-in. choke.

Gravity of the oil is 41.6° in the lower zone, and 41° in the upper pay. Gas-oil ratios are low, 746 cu. ft. per bbl. in lower zone, and 940 cu. ft. per bbl. in the upper.

The new field is 5 miles east of Petronilla, and a little more than a mile north of the Kleberg county line. It is more than a mile east of the large Luby field, and about 2 miles west of South Chapman Ranch field.

## Log-interpretation school slated soon

A series of advanced log interpretation schools will be conducted in major oil centers during the latter part of this year and early 1961. Presently, schools are scheduled in Amarillo, Tulsa, Dallas, and Houston. The course of study extends for 2 weeks, including 10 days for lectures, problems, and discussions.

Registration will be limited to 10 men for these classes. Dates for the various classes are: October 10-21 in Amarillo, November 28-December 9 in Tulsa, January 20-February 10 in Dallas, and sometime in March in Houston. Those interested contact R. G. Hamilton at Box 7293, Tulsa.

## Geologist meeting has natural-gas theme

Sixteen papers, most of them dealing with natural gas, will be presented at the third annual meeting of the Southwestern Federation of Geological Societies in Abilene, Tex., October 12-14.

Up to 1,000 geologists are expected for the convention, which is also designated a regional meeting of the AAPG. The Southwestern Federation is composed of nine geological societies in


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So-called drilling soap and drilling detergent materials range from commercial, household detergents, which contain only about 15 per cent active surface tension reducing agent and 85 per cent water softener (such as soda ash, phosphates, etc.), to solutions of various fatty soaps and detergents in water. Some of these materials have no film-forming characteristics and actually dissolve whatever lubrication properties there are in the system away from the bit bearings and races. They also accelerate corrosion and pitting of the drill pipe and collars.

There are some lubricating qualities in such materials, but in order to achieve the concentration necessary to be effective in the system, the cost would be much more than any benefits derived from their use. Some of these solutions contain as much as 80 or 90 per cent water — yet cost as much as $4.00 per gallon. In dry form, this means that the active material could cost as much as $2.35 per pound, compared to less than 1/10 of that amount per pound for Seeco-Mul.

Seeco-Mul is often used as a drilling soap because it is one of the most efficient surface tension reducing agents available. It is a chemical emulsifier with superior wetting ability, and in addition Seeco-Mul is an effective extreme pressure lubricant.

The combined action of E-P lubrication and low surface tension not only affords greatly increased bit bearing life, but increases the penetration rate also. Since a tough, impervious film is formed on all metal surfaces, hydrogen-weakening (and subsequent failure) of bit bearings, drill pipe, and collars is practically eliminated. This protection is valuable in water containing hydrogen sulfide and other inorganic sulfides ("sulfur water").

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*2. Faster penetration rate.*
*3. Larger cuttings.*
*4. Protection against corrosion and pitting of metal that comes in contact with the drilling fluid (especially valuable in sulfur water).*
*5. Lower surface tension.*
*6. Lower mud costs.*

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|---|---|---|---|---|
| Description | — | Dry Flake | Water Solution | Water Solution |
| Concentration | — | ½#/Bbl. | ½#/Bbl. | ½#/Bbl. |
| Surface Tension Dynes /CM, 25°C. | 74 | 29 | 29 | 30 |
| E. P. Test | Failed 25 In./Lbs. | Passed 400 In./Lbs. | Failed 90 In./Lbs. | Failed 120 In./Lbs. |
| Equivalent Timken Reading | 10 Lbs. | 97 Lbs. | 38 Lbs. | 49 Lbs. |

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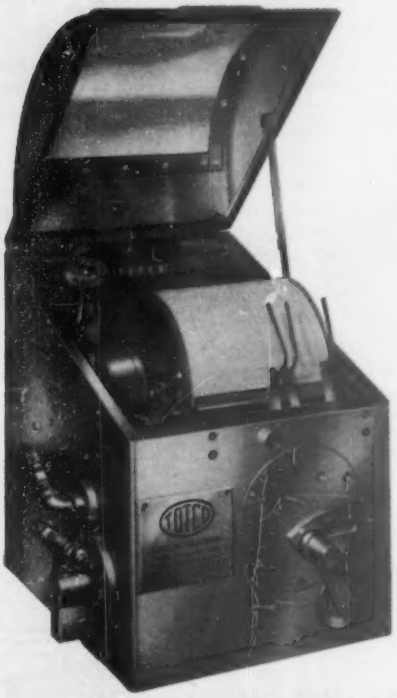

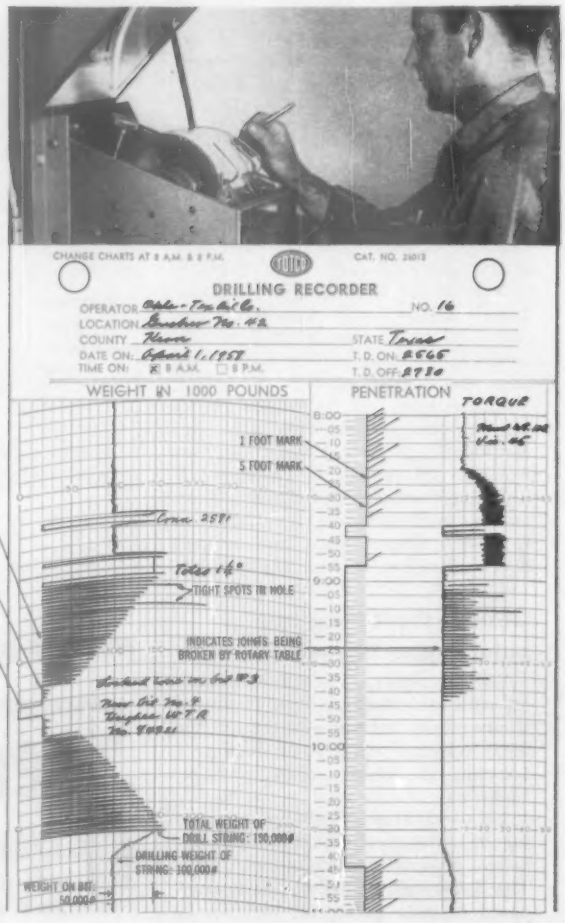


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Texas and New Mexico with an overall membership of about 3,000.

For registration forms and information, contact the Abilene Geological Society. Registration desk will be at the Wooten Hotel.

Theme for the meeting is "Natural Gas in the Southwest."

## Texas reentry produces strike

An old dry hole in the Cabeza Creek area of Goliad County, in Texas' central coastal region, has been reentered and turned into a rich gas-condensate producer.

The well, reworked by Miller & Fox Drilling Corp., is productive from Reklaw sand, a new pay zone for the area. From perforations at 7,389-91 ft. it tested for an open-flow potential rating of 3,400 M.c.f.d. of gas with 64 bbl. of 59.2°-gravity condensate per M.M.c.f. of gas.

Flowing pressure was 1,448 psi. through 16/64-in. choke, 1,881 psi. through 8/64-in. choke.

Location is at the northeast end of Cabeza Creek's Pettus and Wilcox sand production. The well, 1 W. D. Lude, was drilled in 1950 to 7,908 ft., where its original operators (Ryan, Hays, & Burke) plugged it. Present operators redrilled it to 7,833 ft.

## Oklahoma areas make oil news

OKLAHOMA PANHANDLE and Kingfisher County areas figured highly in last week's exploratory highlights in the Sooner State.

**Beaver County.** A dual completion is reported in Beaver County south of Highland field at Oklahoma Natural Gas Co.'s 1 Robertson in NE NE SW 16-2n-28eCM.

The dual-zone discovery flowed 1,180 M.c.f.d. plus 120 bbl. of oil in 9 hours on 15/64-in. choke from perforations at 7,646 67 ft. in the upper Morrow Pennsylvanian; from the lower Morrow at 7,742-49 and 7,793-7,809 ft. the well made 1,720 M.c.f.d. and 16 bbl. condensate in 6 hours.

**Kingfisher County.** Sinclair Oil & Gas Co. 1 Kudlac in C SW SW 10-19n-6w, East Hennessey field well, flowed 204 bbl. of oil per day on 20/64-in. choke from open hole in the Meramec Mississippian at 6,740-95 ft. It flowed 9 bbl. per day through ¼-in. choke from the Manning Mississippian at 6,521-51 ft.

Pan American Petroleum Corp. 1 Mueggenborg in C NE SW 29-16n-7w, Southwest Kingfisher field, flowed 3,105 M.c.f.d. through ¼-in. choke


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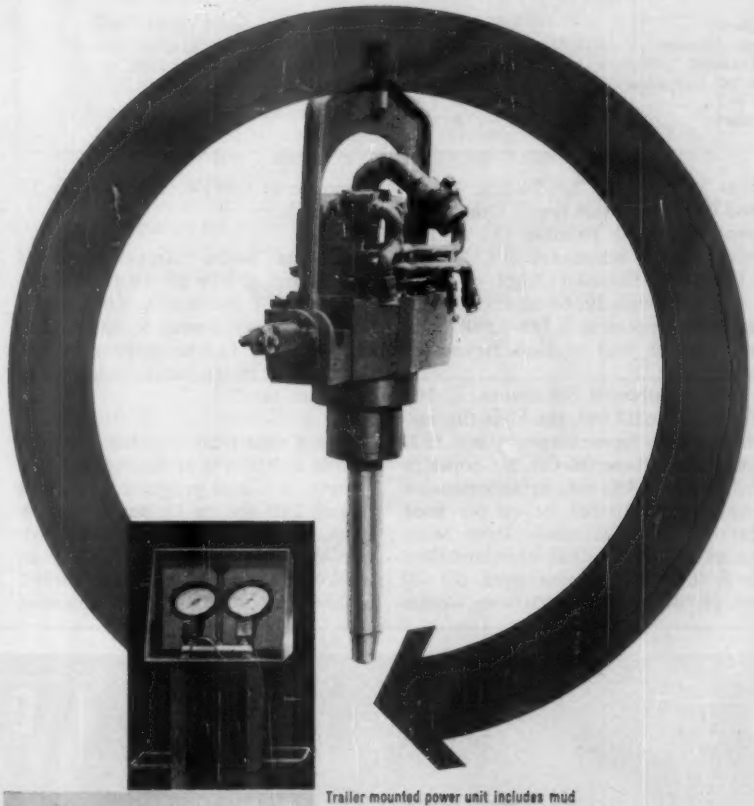

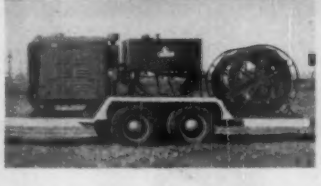

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## Canada August completions

| | TOTAL WELLS | | | | | | | WILDCATS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Oil | Gas | Dry | Service | Footage | Cum. 1960 | Total | Oil | Gas | Dry | Footage | Cum. 1960 |
| **Western Canada** | **255** | **145** | **38** | **54** | **18** | **1,406,813** | **1,649** | **55** | **7** | **10** | **38** | **290,598** | **440** |
| Alberta | 189 | 97 | 36 | 38 | 18 | 1,153,809 | 1,119 | 39 | 4 | 8 | 27 | 231,741 | 289 |
| Saskatchewan | 54 | 42 | 1 | 11 | 0 | 214,026 | 370 | 11 | 3 | 1 | 7 | 42,303 | 79 |
| Manitoba | 5 | 3 | 0 | 2 | 0 | 13,155 | 43 | 2 | 0 | 0 | 2 | 7,040 | 8 |
| British Columbia | 6 | 3 | 1 | 2 | 0 | 24,849 | 103 | 2 | 0 | 1 | 1 | 8,540 | 50 |
| N.W.T. | 1 | 0 | 0 | 1 | 0 | 974 | 14 | 1 | 0 | 0 | 1 | 974 | 14 |
| **Ontario** | **32** | **3** | **12** | **13** | **4** | **34,693** | .... | ... | ... | ... | ... | ..... | .... |

from Manning at 7,765-82 ft. to extend the field 1 mile north. Other area events included Humble Oil & Refining Co.'s 2 Schimanek in C NE SE 9-19n-6w. It flowed 113 bbl. of oil in 4 hours through 20/64-in. choke from the Mississippian at 6,769-6,868 ft. to add another well to East Hennessey field.

The 1 Bohomill Schimanek, C NE SW 9, flowed 2 bbl. per hour through ½-in. choke from Manning at 6,593-6,628 ft. Marion Oil Co. 2 Cooper in C NE SW 1-19n-6w, in an extension area, flowed 10 bbl. of oil per hour through 24/64-in. choke from Mannin at 6,344-83 ft. The Cleveland sand at 5,794-5,830 ft. was good for 20 bbl. per hour through 20/64-in. choke. Meramec at 6,561-6,608 ft. made 37 bbl. per hour.

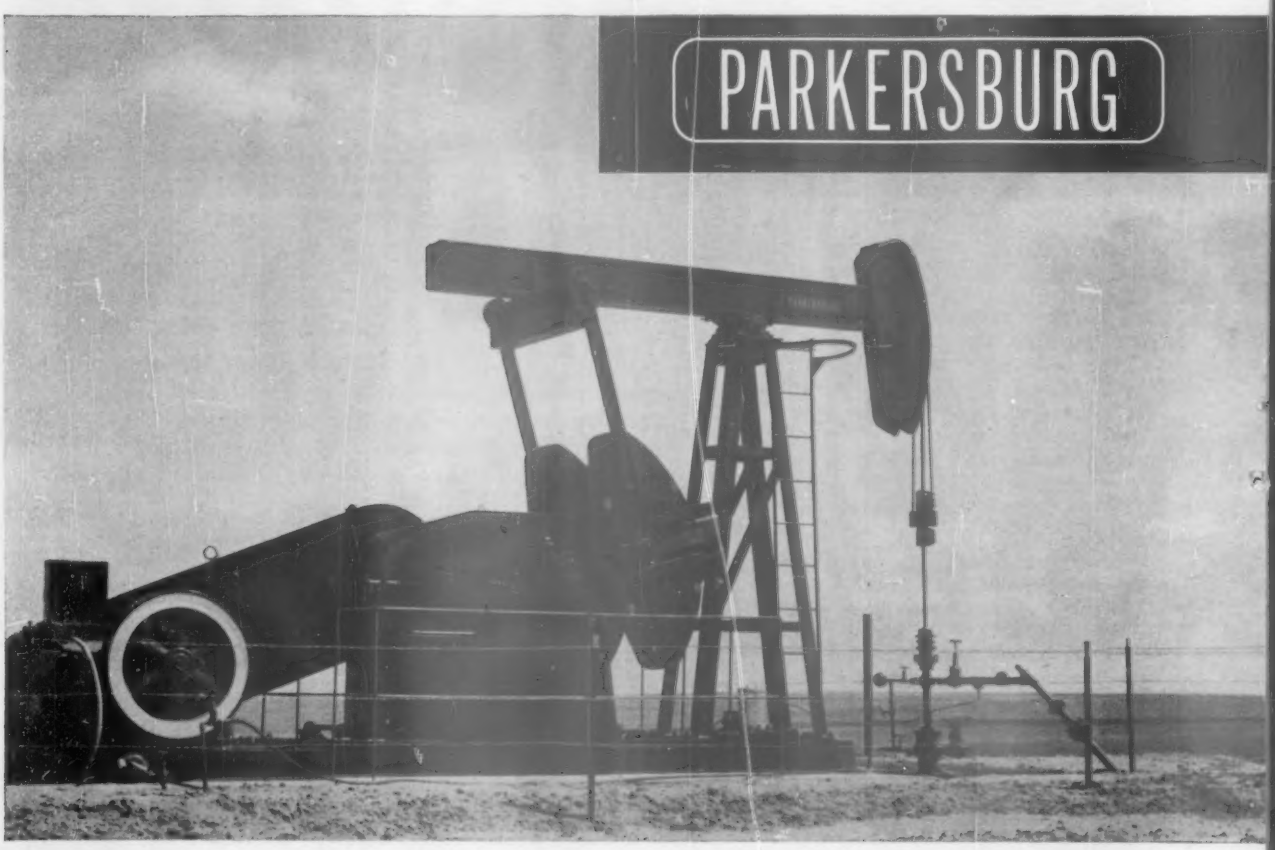
**Arkoma basin.** Ambassador Oil Co. 1 Ford, C NW SE 15-8n-19e, the fifth well in Northwest Kinta field, Haskell County, flowed 4,068 M.c.f.d. on final test from perforations at 5,836-46 ft. in the basal Atoka Pennsylvanian sand.

**East Criner field.** Sinclair 2 Bingaman in C NW SW 21-6n-3w, McClain County, is a dual producer. The well flowed 289 bbl. in 11 hours through ¼-in. choke from Bromide Ordovician at 9,672 to 9,750 ft.; from Hunton Siluro-Devonian it flowed 265 bbl. in 15 hours through 21/64-in. choke at 8,770-94 ft. Both oil flows had accompanying gas.

## Utah's Lisbon may add Pennsylvanian pay

THE PENNSYLVANIAN may come to the Lisbon area of Utah as a new producing horizon. Pure Oil Co. swabbed 10-15 bbl. of oil per hour at 2 Northwest Lisbon-C in NE NW 3-30s-24e, San Juan County.

Recovery is from three zones in the Paradox salt at 5,849 to 5,970 ft. Drill-stem flow was 299 bbl. of oil in 5½ hours. Location is ½ mile north of Mississippian and Devonian production at Lisbon field. There



were no shows of commercial worth at this well in these two above zones. There is some shut-in gas production from Pennsylvanian at Monticello 15 miles southeast, but closest real Pennsylvanian production at 30 miles or so south at Hatch at the north side of Aneth region production in the Paradox basin. If completed successfully, the new well would open first Pennsylvanian-salt-zone production in the basin.

Belco Petroleum Corp. got 127½ bbl. of oil per day on tests at the 2 Belco-State in C NE NE 16-30s-24e, San Juan County. Flow is from Mississippian it is thought. Zone is at 8,697-8,727 ft. Locaion is 1 mile southwest of the Lisbon field discovery well.

## Kansas' Hamilton County adds gas pool

Gas production was tapped at a Hamilton County wildcat in southwestern Kansas. Discovery is Hamilton Brothers Inc. 1-33 Tracy in C SW 33-23s-42w, 4 miles northwest of the town of Syracuse.

The well flowed 1,536 M.c.f.d. from perforations in the Chase group of Permian age through perforations at 2,306-10 ft. The well could be a long extension to regular Hugoton field Chase group production to the east.

**Hodgeman County.** Mississippian production is reported at a wildcat drilled by Pickrell Drilling Co. at 3 Selfridge in C SE SE 8-21s-22w, Hodgeman County. The well got 244 bbl. per day from perforations at 4,360-64 ft. Location is in North Wieland field and is the best well yet here.

**Chautauqua County.** Gas production is reported at a southeastern Kansas wildcat, Pure Oil Co. 2

## New Journal policy on tear sheets, reprints

For many years the Journal has been happy to supply readers with complimentary tear sheets and reprints of articles. Rising costs of handling and postage now force us to make a small service charge for these items.

Beginning October 1, 1960, if the article is available, a charge of 10 cents per page will be made for all tear sheets ordered (minimum charge 25 cents). Reprints of Journal articles, when available, will be charged for at the rate of 50 cents per copy. Payment or company purchase order must be sent with order.

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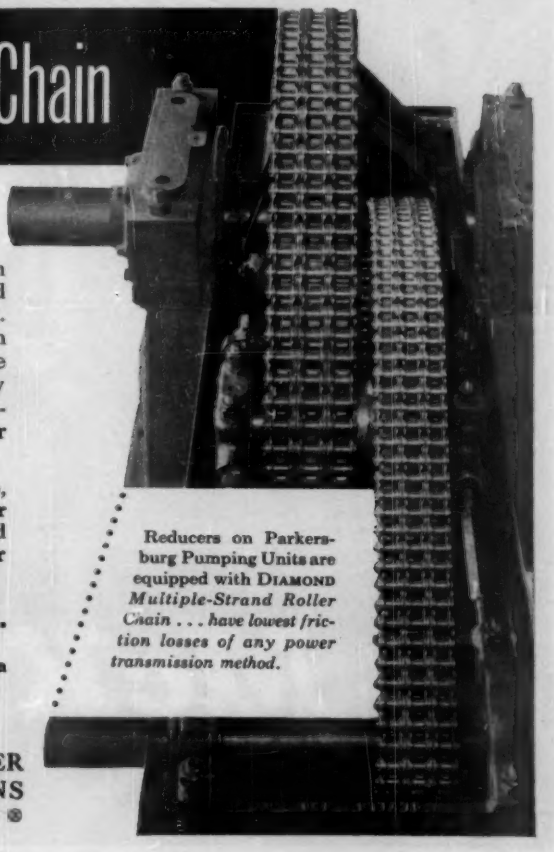

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M.K.O. Coachlines in SW SE SE 10-32s-8e. Flow was 4 M.M.c.f.d. from the Layton through perforations at 1,758-62 ft.

## Gas border stretches east in Ohio's Richland field

In Ohio, the gas play in Richland field continues to move eastward.

Doty Oil Co. reported a good gasser, 14,280 M.c.f.d. after fracture of 1 Benedict Inc., Section 14, Swan Township, Vinton County. This ¾-mile stepout had the Clinton pay at 2,944-60 ft. with a natural gage of 1,176 M.c.f.d. and rock pressure of 900 psi.

In south-central Marion Township, Hocking County, a third producer in the Newburg horizon was finaled with an estimated flow of 4 M.M.c.f.d. Holl Brothers acidized the 1 Loy Daubenmire, Section 34, in the pay from 2,281 to 2,290 ft. It had a natural gage of 800 M.c.f.d. with a rock of 825 psi.

In addition to these Newburg producers, the same operators have a string of 14 Clinton oil successes in the immediate area with an average initial of 30 barrels of oil per day per well.

## *Discovery wells*

**ARKANSAS**

Crawford County:

Ambassador Oil Corp. 1 Star Greig, 330 ft. east of center, 35-9n-31w, ½ mile southwest of Westville and 3¾ miles southeast of Van Buren. IP 971 M.c.f.d., calculated open flow, 400 psi., perf. 1,699-1,727 ft., upper Alma sand; 2,610 M.c.f.d., 850 psi., perf. 4,558-78 ft. and 4,684-98 ft., upper and lower Barton sands; and 4,566 M.c.f.d., 1,820 psi., perf. 5,584-5,614 ft., lower Hale sand. TD 5,709 ft. Deep pay discoveries and mile-extension in old Kibler shallow gas area.

**ALBERTA**

Lac La Biche. Dome-Provo 11-16 Daken, LSD 11, 16-67-17w4. IP 1,500 M.c.f.d., Glauconitic 1,773-86 ft. TD 1,870 ft. Gas discovery.

Morrin. Amerada Crown BW 5-34 Morrin, LSD 5, 34-31-20w4. IPF 4 M.M.c.f.d., Pekisko 4,320-4,450 ft. TD 6,600 ft. Gas discovery.

Oyen. Samedan Crown 10-1 Oyen, LSD 10, 1-29-6w4. IP 180 M.c.f.d., Viking 2,553-59 ft. TD 3,200 ft. Gas discovery.

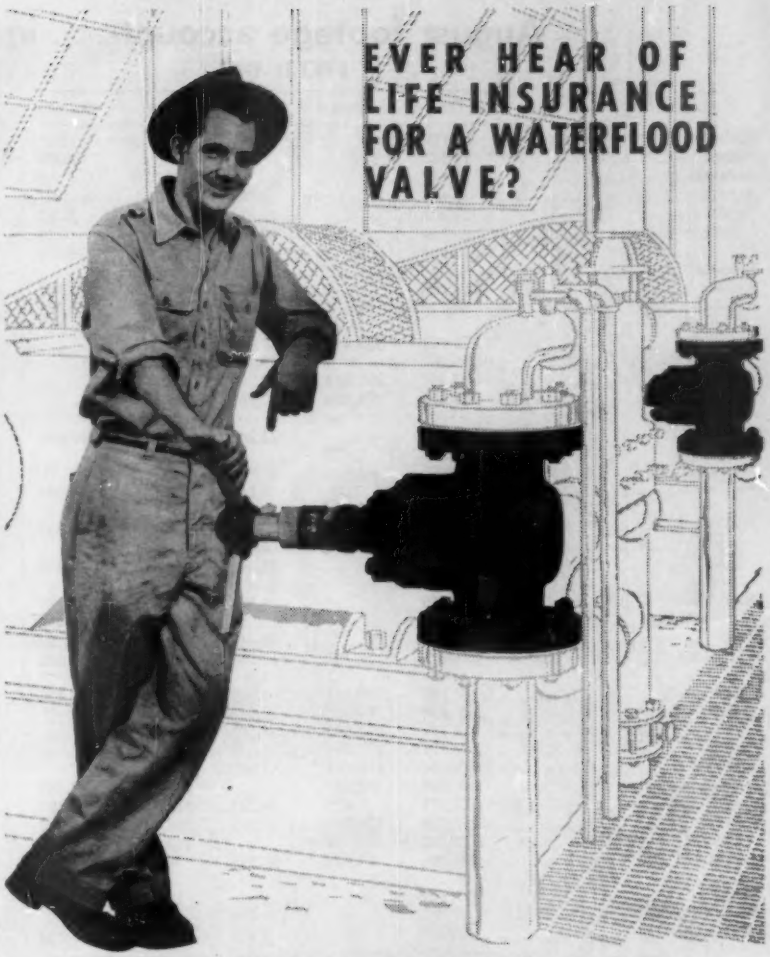
Schneider Lake. Banff-Hudson's Bay 4-28 Schneider Lake, LSD 4, 28-41-13w4. IPF 2,750 M.c.f.d., Basal Quartz 3,044-53 ft. TD 3,296 ft. Gas discovery.

North Sturgeon Lake. Cities Service-British American 3-26 North Sturgeon Lake, LSD 3, 26-72-24w5. IPF 5,250 M.c.f.d., Cadomin 4,510-90 ft. TD ? Drilling.

Vulcan. Cancrude-British American 7-24 Vulcan, LSD 7, 24-16-25w4. Rumored to be Basal Quartz discovery. TD 6,430 ft. No other information.

Saskatchewan:

Kisbey. Placid-Tidewater 9-10 Gapview,


Maybe not—but you *get* it, automatically, when you specify the Demco Valve for waterflood operations! Because Demco's unique design and construction give you *built-in insurance* for longer, troublefree valve life against the highly-corrosive qualities of salt waterflooding. With Demco's high-pressure gate valve, you get a positive rubber-to-metal seal—tough synthetic rubber against corrosion-resistant stainless, Monel, aluminum bronze or ductile iron.

And the Demco Valve seals drop-tight without applying undue torque to the stem! The body remains in line while the entire inner assembly lifts out for easier, faster inspection. Fewer parts are subject to wear. Design allows constant self-lubrication of stem threads, protection from abrasives by *double* stem seal.

Countless troublefree installations have proved this versatile valve's rugged performance under the most difficult waterflood conditions. Why not let the Demco Valve's "life insurance" work for you, too?

Available at supply stores everywhere in 1,000, 2,000, 3,000 and 5,000 psi working pressures . . . in two-to four-inch sizes.

**DRILLING EQUIPMENT MANUFACTURING CO.**

845 S. E. 29th Street • OKLAHOMA CITY

DEMCO

# August footage account . . . in the U. S.

| | FIELD WELLS | | | | | WILDCAT WELLS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Oil | Cond. | Gas | Dry | Service | Oil | Cond. | Gas | Dry |
| Alabama | 34,683 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 871 |
| Alaska | 11,520 | ..... | ..... | ..... | 3,000 | ..... | ..... | ..... | ..... |
| Arizona | 11,182 | ..... | ..... | 1,036 | ..... | 6,212 | ..... | ..... | 785 |
| Arkansas | 76,605 | ..... | 9,031 | 27,751 | ..... | 2,738 | ..... | 13,003 | 28,937 |
| California | 323,113 | ..... | 48,471 | 89,427 | 2,762 | 1,055 | ..... | 23,075 | 241,742 |
| Colorado | 28,564 | ..... | 60,131 | 50,382 | ..... | 12,148 | ..... | 14,659 | 175,674 |
| Illinois | 211,928 | ..... | ..... | 159,635 | 176,019 | 11,718 | ..... | ..... | 102,200 |
| Indiana | 52,730 | ..... | 2,634 | 74,511 | ..... | 5,774 | ..... | 1,093 | 49,824 |
| Kansas | 568,200 | ..... | 84,341 | 309,643 | 71,175 | 50,153 | ..... | 20,425 | 265,851 |
| Kentucky | 52,115 | ..... | 86,940 | 77,771 | 225,829 | 4,697 | ..... | ..... | 5,933 |
| Louisiana | 1,274,819 | 352,424 | 142,974 | 676,547 | ..... | 25,469 | ..... | ..... | 426,651 |
| North | 216,967 | ..... | 83,265 | 151,225 | ..... | 25,469 | ..... | ..... | 120,594 |
| South | 803,461 | 280,864 | 38,740 | 420,799 | ..... | ..... | ..... | ..... | 281,014 |
| Offshore | 254,391 | 71,560 | 20,969 | 104,523 | ..... | ..... | ..... | ..... | 25,043 |
| Michigan | 174,542 | ..... | 22,242 | 88,639 | 15,663 | ..... | ..... | 3,020 | 77,635 |
| Mississippi | 233,892 | 8,427 | ..... | 61,976 | ..... | 25,540 | ..... | ..... | 255,038 |
| Montana | 69,666 | ..... | ..... | 22,902 | ..... | ..... | ..... | ..... | 67,528 |
| Nebraska | 172,503 | ..... | 5,144 | 174,683 | 10,054 | 10,771 | ..... | ..... | 196,610 |
| New Mexico | 533,222 | 13,011 | 250,042 | 50,580 | 12,849 | 33,384 | 13,072 | ..... | 97,526 |
| West | 84,132 | 13,011 | 214,344 | 9,661 | ..... | ..... | ..... | ..... | 22,819 |
| East | 449,090 | ..... | 35,698 | 40,919 | 12,849 | 33,384 | 13,072 | ..... | 74,707 |
| New York | 10,840 | ..... | 5,146 | 3,933 | 7,997 | ..... | ..... | 5,426 | 16,534 |
| North Dakota | 84,795 | ..... | ..... | 17,706 | 9,422 | ..... | ..... | ..... | 38,608 |
| Ohio | 105,409 | ..... | 64,313 | 49,608 | 30,482 | ..... | ..... | ..... | 12,932 |
| Oklahoma | 523,913 | 25,989 | 165,337 | 245,420 | 107,642 | 34,188 | 17,303 | 14,807 | 193,027 |
| Texas | 2,796,181 | 736,531 | 304,049 | 1,106,206 | 94,424 | 146,914 | 60,715 | 30,936 | 1,147,315 |
| Dist. 1 | 97,498 | 18,005 | 2,825 | 49,714 | ..... | 5,854 | ..... | 720 | 80,719 |
| Dist. 2 | 118,357 | 72,889 | 41,562 | 113,237 | ..... | ..... | ..... | ..... | 191,371 |
| Dist. 3 | 242,717 | 172,034 | 22,427 | 159,312 | ..... | 34,143 | 13,048 | ..... | 153,654 |
| Dist 4 | 149,411 | 116,651 | 83,985 | 105,604 | ..... | 7,425 | 13,880 | 10,520 | 123,423 |
| East | 281,788 | 88,031 | ..... | 117,310 | 5,585 | 15,716 | 13,614 | ..... | 104,080 |
| Dist. 7-B | 228,177 | 7,475 | 36,227 | 112,337 | 8,495 | 13,979 | ..... | ..... | 194,194 |
| West | 1,157,356 | 129,974 | 20,445 | 264,127 | 45,614 | 53,311 | 10,531 | 19,696 | 203,155 |
| Dist. 9 | 324,591 | 35,654 | ..... | 110,236 | 28,020 | 16,486 | ..... | ..... | 78,634 |
| Dist. 10 | 196,286 | 95,818 | 96,578 | 74,329 | 6,710 | ..... | 9,642 | ..... | 18,085 |
| Utah | 57,575 | ..... | ..... | 11,510 | ..... | 5,726 | ..... | 10,225 | 13,282 |
| West Virginia | 8,392 | ..... | 175,891 | 7,544 | ..... | ..... | ..... | 6,004 | 13,001 |
| Wyoming | 248,920 | ..... | 7,412 | 44,643 | 11,220 | 4,285 | ..... | 22,373 | 248,442 |
| **Total U. S.** | **7,665,309** | **1,136,382** | **1,434,098** | **3,352,053** | **778,538** | **380,772** | **91,090** | **165,046** | **3,675,946** |

# . . . and in Western Canada

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Total** | **793,791** | ..... | **139,917** | **81,829** | **100,678** | **32,638** | ..... | **53,735** | **204,255** |
| Alberta | 618,250 | ..... | 139,917 | 63,223 | 100,678 | 20,437 | ..... | 46,415 | 164,889 |
| Saskatchewan | 156,212 | ..... | ..... | 15,511 | ..... | 12,201 | ..... | 3,070 | 27,032 |
| Manitoba | 6,115 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 7,040 |
| British Columbia | 13,214 | ..... | ..... | 3,095 | ..... | ..... | ..... | 4,250 | 4,290 |
| N.W.T. | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 974 |

LSD 9, 10-9-6w2. IPF 2 BOPH, 32.3°, Mississippian 3,909-20 ft. TD 4,170 ft. Oil discovery.

Hoosier. Altair-Harrinton-Marsh 6-3 Antelope Lake, LSD 6, 3-32-27w3. IPF 5,470 M.c.f.d., Banff sand 2,690-98 ft. TD 3,070 ft. Production testing in Viking.

British Columbia:

Beatton River. Imperial - Pacific - Sunray b-68-C Wargen, b-68-C-94-H-6. IPF 21 M.M.c.f.d. on 8-hour test, open flow. Bluesky 3,698-3,708 ft. TD 4,250 ft. Gas discovery. Production testing.

### COLORADO

La Plata County, Ignacio-Blanco field area:

Consolidated Oil & Gas Co. 2-29 Spring Creek, SW SW 29-35n-6w. IPF 1,150 M.c.f.d., ¾-in. choke. Mesaverde 5,354-5,537 ft. TD 8,154 ft. PBTD 5,570 ft. Mesaverde discovery, new pool.

### NORTH LOUISIANA

Claiborne Parish:

Petro-Atlas, Inc., 1 Sale et al., SE SE SE 6-22n-7w, 2 miles southeast of Haynesville. IP 98 BOPD, 12/64-in., 47°, GOR 1,500 cu. ft. per bbl., TP 500 psi., perf. 10,684-10,704 ft., Haynesville lime. TD 11,167 ft. in Smackover. New-field discovery.

### SOUTH LOUISIANA

Plaquemines Parish:

U. S. Oil Co. of Louisiana, Inc., 1 State Lease 2153, 3-17s-26e. IP 480 BOPD, 12/64-in., 36°, GOR 1,083 cu. ft. per bbl., TP 1,950 psi., perf. 11,378-88 ft., and 552 BOPD, 12/64-in., 32.2°, GOR 645 cu. ft. per bbl., TP 1,750 psi., perf. 10,573-75 ft. TD 11,620 ft. Second well and new-pay discoveries in Diamond field.

### MISSISSIPPI

Amite County:

Justiss-Mears Oil Co. et al. 1-B Board of Supervisors, SE SE NE 16-3n-5e. IPP 103 BOPD and 43 BW, perf. 10,616-19 ft., Tuscaloosa. TD 11,515 ft. New-field discovery.

### NEW MEXICO

Eddy County:

Texas Pacific Coal & Oil Co. 1 U.S.A.-Wooley, 25 miles east of Artesia in 21-17s-30e. IPP 1,600 BOPD, ½-in. choke, Abo 6,750-6,830 ft. 44°, GOR 1,268:1, TP 700 psi., packer. TD 6,945 ft. PBTD 6,875 ft. New oil discovery.

San Juan County:

Delhi-Taylor 1 Delhi-Ludwick, NE NE 19-30n-10w. IPF 1,996 M.c.f.d., ¾-in. choke. SITP 2,079 psi. SICP 2,061 psi. Graneros-Dakota 7,258-7,445 ft. Dakota discovery, new pool. TD 7,556 ft. PBTD 7,476 ft.

# The August Well Count in the U. S.

| State— | Total completions | | | | | | | | | Cable-tool comp. | D.D. | Wildcats | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Oil | Cond. | Gas | Dry | Service | Footage | Cum. wells 1960 | Cum. footage 1960 | | | Total | Oil | Cond. | Gas | Dry | Footage | Cum. wells 1960 | Cum. footage 1960 |
| Alabama | 4 | 3 | 0 | 0 | 1 | 0 | 35,554 | 32 | 333,712 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 871 | 2 | 3,517 |
| Alaska | 2 | 1 | 0 | 0 | 0 | 1 | 14,520 | 10 | 110,521 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 38,029 |
| Arizona | 6 | 3 | 0 | 0 | 3 | 0 | 19,215 | 24 | 53,655 | 0 | 0 | 3 | 1 | 0 | 0 | 2 | 6,997 | 18 | 38,335 |
| Arkansas | 46 | 23 | 0 | 5 | 18 | 0 | 158,065 | 402 | 1,463,590 | 0 | 1 | 14 | 1 | 0 | 3 | 10 | 44,678 | 111 | 432,735 |
| California | 154 | 86 | 0 | 13 | 54 | 1 | 729,645 | 1,087 | 5,066,437 | 0 | 15 | 42 | 1 | 0 | 4 | 37 | 265,872 | 212 | 1,185,573 |
| Colorado | 67 | 8 | 0 | 13 | 46 | 0 | 341,588 | 423 | 2,059,632 | 0 | 0 | 40 | 2 | 0 | 2 | 36 | 202,481 | 215 | 1,051,870 |
| Florida | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 46,332 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 46,332 |
| Illinois | 314 | 92 | 0 | 0 | 116 | 106 | 661,500 | 1,503 | 3,020,978 | *41 | 5 | 56 | 6 | 0 | 0 | 50 | 113,918 | 308 | 562,766 |
| Indiana | 137 | 40 | 0 | 4 | 93 | 0 | 186,566 | 680 | 929,240 | *67 | 0 | 44 | 5 | 0 | 2 | 37 | 56,691 | 253 | 322,728 |
| Iowa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3,507 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3,507 |
| Kansas | 504 | 215 | 0 | 27 | 234 | 28 | 1,369,788 | 2,352 | 7,930,318 | 40 | 0 | 91 | 13 | 0 | 4 | 74 | 336,429 | 696 | 2,573,283 |
| Kentucky | 367 | 47 | 0 | 25 | 60 | 235 | 453,285 | 1,313 | 1,784,587 | 298 | 0 | 7 | 3 | 0 | 0 | 4 | 10,630 | 118 | 174,291 |
| Louisiana | 386 | 188 | 29 | 32 | 137 | 0 | 2,898,884 | 2,382 | 19,069,837 | 0 | 0 | 57 | 6 | 0 | 0 | 51 | 452,120 | 376 | 3,256,021 |
| North | 167 | 82 | 0 | 26 | 59 | 0 | 597,520 | 889 | 3,442,372 | 0 | 0 | 30 | 6 | 0 | 0 | 24 | 146,063 | 179 | 914,730 |
| South | 176 | 81 | 23 | 4 | 68 | 0 | 1,824,878 | 1,157 | 12,007,829 | 0 | 0 | 25 | 0 | 0 | 0 | 25 | 281,014 | 174 | 2,042,181 |
| Offshore | 43 | 25 | 6 | 2 | 10 | 0 | 476,486 | 336 | 3,619,636 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 25,043 | 23 | 299,110 |
| Michigan | 111 | 49 | 0 | 7 | 45 | 10 | 381,741 | 579 | 1,963,409 | 38 | 2 | 21 | 0 | 0 | 1 | 20 | 80,655 | 151 | 557,438 |
| Mississippi | 59 | 24 | 1 | 0 | 34 | 0 | 584,873 | 467 | 4,704,357 | 0 | 0 | 29 | 2 | 0 | 0 | 27 | 280,578 | 178 | 1,754,509 |
| Missouri | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 41,649 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 41,649 |
| Montana | 31 | 11 | 0 | 0 | 20 | 0 | 160,096 | 202 | 979,882 | 0 | 1 | 14 | 0 | 0 | 0 | 14 | 67,528 | 96 | 409,614 |
| Nebraska | 105 | 38 | 0 | 1 | 64 | 2 | 569,765 | 595 | 3,314,597 | 0 | 1 | 37 | 2 | 0 | 0 | 35 | 207,381 | 242 | 1,301,864 |
| Nevada | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7,902 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7,902 |
| New Mexico | 182 | 98 | 3 | 46 | 32 | 3 | 1,003,686 | 1,244 | 6,107,624 | 42 | 1 | 24 | 3 | 1 | 0 | 20 | 143,982 | 191 | 984,953 |
| West | 65 | 16 | 2 | 38 | 9 | 0 | 343,967 | 413 | 1,894,339 | 11 | 0 | 7 | 0 | 0 | 0 | 7 | 22,819 | 46 | 176,916 |
| East | 117 | 82 | 1 | 8 | 23 | 3 | 659,719 | 831 | 4,213,285 | 31 | 1 | 17 | 3 | 1 | 0 | 13 | 121,163 | 145 | 808,037 |
| New York | 27 | 8 | 0 | 4 | 8 | 7 | 49,876 | 211 | 367,825 | 27 | 0 | 7 | 0 | 0 | 2 | 5 | 21,960 | 34 | 121,422 |
| North Carolina | 3 | 0 | 0 | 0 | 3 | 0 | 4,896 | 3 | 4,896 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4,896 |
| North Dakota | 25 | 14 | 0 | 0 | 10 | 1 | 150,531 | 201 | 1,271,479 | 0 | 1 | 7 | 0 | 0 | 0 | 7 | 38,608 | 53 | 293,644 |
| Ohio | 110 | 46 | 0 | 20 | 35 | 9 | 262,744 | 675 | 1,641,205 | 106 | 0 | 3 | 0 | 0 | 0 | 3 | 12,932 | 35 | 123,617 |
| Oklahoma | 394 | 175 | 5 | 39 | 111 | 64 | 1,327,626 | 3,104 | 11,970,506 | 140 | 0 | 59 | 7 | 2 | 3 | 47 | 259,325 | 501 | 2,573,994 |
| Oregon | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 16,685 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 16,685 |
| Pennsylvania | (Not available) | | | | | | | 518 | 1,436,370 | 0 | 0 | .... | .... | .... | .... | .... | ..... | 10 | 62,605 |
| South Dakota | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 119,144 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 24,848 |
| Tennessee | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 49 | 37,998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 36,779 |
| Texas | 1,476 | 744 | 89 | 75 | 532 | 36 | 6,423,271 | 10,678 | 45,892,757 | 53 | 22 | 304 | 22 | 6 | 3 | 273 | 1,385,880 | 2,213 | 10,051,755 |
| District 1 | 103 | 50 | 2 | 2 | 49 | 0 | 255,335 | 740 | 2,023,265 | 0 | 0 | 33 | 1 | 0 | 1 | 31 | 87,293 | 278 | 846,893 |
| District 2 | 85 | 18 | 9 | 10 | 48 | 0 | 537,416 | 521 | 3,449,966 | 0 | 0 | 28 | 0 | 0 | 0 | 28 | 191,371 | 133 | 928,087 |
| District 3 | 114 | 46 | 17 | 5 | 46 | 0 | 797,335 | 820 | 5,717,210 | 0 | 2 | 21 | 3 | 1 | 0 | 17 | 200,845 | 152 | 1,365,381 |
| District 4 | 115 | 34 | 13 | 20 | 48 | 0 | 610,899 | 736 | 4,061,180 | 3 | 1 | 29 | 2 | 2 | 1 | 24 | 155,248 | 210 | 1,183,082 |
| East | 135 | 79 | 13 | 0 | 42 | 1 | 626,124 | 863 | 4,032,375 | 1 | 3 | 24 | 2 | 1 | 0 | 21 | 133,410 | 178 | 1,002,762 |
| District 7-B | 220 | 89 | 2 | 10 | 117 | 2 | 600,884 | 1,551 | 4,371,482 | 0 | 2 | 76 | 4 | 0 | 0 | 72 | 208,173 | 449 | 1,332,841 |
| West | 366 | 235 | 14 | 6 | 96 | 15 | 1,904,209 | 2,797 | 14,055,934 | 14 | 11 | 56 | 7 | 1 | 1 | 47 | 286,693 | 437 | 1,979,977 |
| District 9 | 235 | 144 | 6 | 0 | 71 | 14 | 593,621 | 1,944 | 4,919,867 | 35 | 1 | 33 | 3 | 0 | 0 | 30 | 95,120 | 333 | 1,065,504 |
| District 10 | 103 | 49 | 13 | 22 | 15 | 4 | 497,448 | 703 | 3,261,478 | 0 | 2 | 4 | 0 | 1 | 0 | 3 | 27,727 | 43 | 347,228 |
| Utah | 17 | 11 | 0 | 2 | 4 | 0 | 98,318 | 168 | 939,553 | 0 | 0 | 5 | 1 | 0 | 2 | 2 | 29,233 | 57 | 319,647 |
| Washington | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9,740 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9,740 |
| West Virginia | 78 | 4 | 0 | 71 | 3 | 0 | 210,832 | 543 | 1,351,702 | 72 | 0 | 2 | 0 | 0 | 1 | 1 | 19,005 | 6 | 46,063 |
| Wyoming | 112 | 53 | 0 | 3 | 53 | 3 | 587,295 | 705 | 3,524,921 | 5 | 1 | 47 | 1 | 0 | 2 | 44 | 275,100 | 286 | 1,547,318 |
| **Total August 1960** | **4,714** | **1,981** | **127** | **387** | **1,713** | **506** | **18,679,234** | **30,211** | **127,576,547** | **929** | **54** | **914** | **76** | **9** | **29** | **800** | **4,312,854** | **6,463** | **29,979,929** |
| Total July 1960 | 4,141 | 1,713 | 100 | 406 | 1,507 | 415 | 15,619,217 | ..... | ..... | 943 | 53 | 840 | 70 | 12 | 33 | 725 | 3,821,759 | .... | ..... |
| **Cumulative 1960** | **30,211** | **13,737** | **885** | **2,450** | **11,606** | **1,533** | **127,576,547** | ..... | ..... | **5,376** | **386** | **6,463** | **563** | **71** | **213** | **5,616** | **29,979,929** | .... | ..... |
| Cumulative 1959 | 33,232 | 16,757 | 805 | 2,417 | 12,388 | 865 | 137,877,019 | ..... | ..... | .... | .... | 6,367 | 607 | 84 | 195 | 5,481 | 31,327,447 | .... | ..... |

*Estimated.

# Robinson Rates Vision First

## . . . in the list of requirements for getting the most out of Texas Eastern gas pipeline at bottom expense.

"EITHER YOU lead the field, or you'll get so much mud in your eye you'll be out of the race."

That's how it looks to the breed of young engineers guiding the destiny of the gas-transmission industry today.

Such a man is Ernest T. Robinson, Jr., who 3 months ago became vice president in charge of gas operations for Texas Eastern Transmission Corp.

Robinson, 43, has been with Texas Eastern since its infancy in 1947. His basic job: Operate its 6,300 miles of natural-gas pipeline at the lowest possible cost, but with the efficiency demanded of the present long-line transmission system.

The economics of his fundamental problem are simple. The company can't go on raising rates, nor can it expect to get its gas supply any cheaper. If it expects to remain competitive and still turn a profit in the growth-years ahead, it must learn to move its gas at less cost.

Engineer Robinson knows this can be done only by exploiting every technical advance available.

**Louisianan . . .** Born and reared in Winnsboro, La., Robinson graduated from Louisiana Polytechnic Institute with a civil engineering degree in 1938. His first job was with the U. S. Corps of Engineers at Vicksburg, Miss.

Within a year he went to United Gas Pipeline at Monroe, La., as a junior engineer and draftsman and worked primarily on field lines out of the Monroe gas field.

Four years later he joined Columbian Gasoline and Columbian Carbon at Monroe. He broadened his engineering experience by working as an operator of pipelines, designer and builder of gasoline plants, compressor stations, and pipelines, and as project and field engineer on carbon plants.

**Texas Eastern . . .** When Texas Eastern was born 13 years ago to take over the Big Inch systems of World War II origin, the company cast about for bright young engineers with good training, experience, and vision.

Robinson was hired to help on construction and measurement facilities. His first 3 months were spent in Shreveport and then for nearly 3 years he worked on tying in the system with distribution points in the East.

"I sure got a ribbing from my wife," Robinson recalled last week.

## ▶▶▶ Personals

**George H. Unzelman** has been named chief refinery technologist for Ethyl Corp.'s western region. He will headquarter in Los Angeles.

**Dr. Richard A. Geyer** has been named manager of gravity operations for Geophysical Service, Inc. He will headquarter in Houston. Supervisors in the reorganized gravity department will be **Morris McCord,** Houston, and **Norman Harding,** Denver.

**George W. Blackwood, William P. Gage,** and **D. Walter Robbins, Jr.,** all of W. R. Grace & Co., have been elected directors of Cosden Petroleum Corp., a Grace subsidiary. Blackwood is president of Grace's Dewey and Almy chemical division. Gage, now president of Grace's research division, is a former vice president of Shell Chemical Corp. Robbins is Grace vice president in charge of general development.

**Paul Kimbrell Smith, Jr.,** plant foreman for Mobil Oil Co. in Smackover, Ark., has joined Kerr-McGee Oil Industries, Inc., as staff engineer in the natural-gasoline department, Oklahoma City.

**W. A. Raatz,** group supervisor at California Research Corp.'s Richmond, Calif., laboratory, has been promoted to supervising research engineer in the process-planning section at Richmond. **Dr. William C. Knudsen** has been named senior research physicist, geophysics-research section, at the La Habra, Calif., laboratory.

**R. L. Smith,** production engineer with Gulf Oil Corp. in Goldsmith, Tex., has been transferred to Midland, Tex., as reservoir engineer.

**E. E. Hall,** manager of Southern Natural Gas Co.'s land department in New Orleans, has joined Dixilyn Drilling Corp. as manager of the exploration department in the southeastern division, New Orleans.

**Charles O. Peyton,** head of the petroleum specialties department of Humble Oil & Refining Co.'s Esso Standard division, has been named manager of industrial and consumer sales for the division. He succeeds **Charles W. Bohmer, Jr.,** who recently moved to Houston as assistant to Humble's vice president and director for marketing.

"She thought we were going to settle down in Shreveport."

In late 1949 he became assistant pipeline superintendent for operations and in July, 1951, at 33, he was named to organize and manage the company's District 5 at Lebanon, Tenn.

A bigger test as an administrator came in 1954. The company called him back to Shreveport with the title of assistant general superintendent for operations. Since there was no general superintendent, he had the entire responsibility—and in 1957 he got that title, too.

Last June Robinson gained a vice presidency, succeeding E. R. Cunningham, who retired. Until a new general superintendent is named, Robinson will hold the job.

Through the years, Robinson did valuable work on centrifugal compressors, scraper-running and line-cleaning, the use of turbines, installation of automatic and remote controls, and use of computers.

Changes in pipelining technique have meant struggles for the engineer, Robinson says.

"Most of those who were in pipelining from the beginning had learned their jobs through trial-and-error and when the engineer came in, he had a tough row to hoe. Some of the old-timers would say, 'We did it that way 30 years ago—why change?' But we say you can't sit idly by and say we will do it that way tomorrow.

"Texas Eastern management has not hesitated to grab new ideas, even though the company had its neck out many times."

That policy shapes up as a logical extension of Robinson's basis job: Cut costs and operate efficiently.

---

**Lewell Adair,** operations manager for Venezuelan Atlantic Refining Co. in Caracas, has been named vice president and manager of Libyan Atlantic Co. He will headquarter in Tripoli.

**C. E. Cunningham** has been promoted to senior supervising engineer in the technical division of Humble Oil & Refining Co.'s Baytown, Tex., refinery. He will head the electrical-engineering section.

**Louis R. Fleming, Jr.,** petroleum engineer with Union Producing Co., has been transferred to Jackson, Miss., from New Orleans. **Gerald R. Hare,** assistant petroleum engineer, has moved to New Orleans from Houma, La., and **Paul B. Sellers, Jr.,** assistant petroleum engineer, has been transferred to Houston from Lafayette, La.

**Harry A. Carlson,** geologist and geophysicist with The California Co., has resigned to open offices as geophysical consultant in Denver.

**Robert A. Young, Jr.,** has been appointed drilling superintendent for Brewster-Bartle Drilling Co., Inc., and Brewster-Bartle Offshore Co. **William O. Bartle, Jr.,** has been appointed assistant to the drilling superintendent.

**W. F. Cummer,** section supervisor in United Gas Corp.'s research department, Shreveport, La., has been promoted to manager of economic analysis, a new position in the Shreveport sales and rate department.

**Homer E. Allspach,** assistant manager of Union Carbide Chemicals Co.'s Texas City plant, has been promoted to plant manager. He succeeds **T. A. Wilker,** who has been transferred to the company's New York office as a production manager. **Harold Walker,** maintenance superintendent of the Texas City plant, will succeed Allspach there.

**John M. Sprague,** who recently completed a 2-year assignment with the Defense Department as deputy assistant secretary of defense, will become Washington representative for Humble Oil & Refining Co. October 15. Sprague was a regional vice president of Carter Oil Co., now Carter division of Humble, before his Defense Department assignment. **William R. Veal** will serve as attorney in Humble's Washington office.

**Edd R. Turner,** division geologist for Tidewater Oil Co. in Houston, has been promoted to asssistant southern division exploration manager. **R. W. Snyder,** assistant division geologist, will succeed Turner. Seven district exploration managers have been named to direct field exploration operations in Tidewater's southern division. They are: **R. P. Grigg,** southeast Louisiana district, New Orleans; **Paul Morvant,** Southwest Louisiana district, Lafayette; **J. P. O'Connor,** Texas Gulf Coast, Corpus Christi; **E. G. Young,** East Texas, Tyler; **W. P. Siard,** Oklahoma district, Oklahoma City; **T. J. Pujol,** West Texas, Midland; and **J. D. Divelbiss,** Four Corners, Durango, Colo. In other appointments, **John L. Stoops** has been named southeast Louisiana district geologist and **James B. Davis** has been named southwest Louisiana district land man. **J. W. Chappell** will be Oklahoma district geologist. **Homer E. Olivier** has been named district geologist and **Revill M. Rogers** has been named district geophysicist in the Four Corners district.

## ▶▶▶ Personals

**Richard C. Sauer,** senior vice president in charge of supply and transportation and a director of Standard Oil Co. (Ohio), has been named executive vice president. He will be responsible for the company's refining, marketing, supply and transportation activities. **E. B. McConnell,** who had been senior vice president for

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McCONNELL

manufacturing and research, will be senior vice president, research. Sauer became vice president, supply and distribution, in 1947 and was elected a director in 1958. He was named senior vice president last year. McConnell was named general manager of manufacturing in 1945, vice president and a director in 1946, and senior vice president in 1959.

**George W. Butler,** coordinator of world-wide marketing activities for Standard Oil Co. (N. J.), has been elected a director of Esso Research & Engineering Co.

**Warren O. Carlson,** formerly with C. W. Nofsinger Co., Kansas City consulting firm, has joined Beaco, Ltd., Montreal consultants, as vice president in charge of the refining division. He will be responsible for all activities in the petroleum-refining, petrochemical, and gas-processing fields. Carlson will headquarter in Calgary.

**Ronald R. McNaughton,** Consolidated Mining & Smelting Co. of Canada, Ltd., will take office February 28 as president of American Institute of Mining, Metallurgical, and Petroleum Engineers. **Lloyd E. Elkins,** production research director of Pan American Petroleum Corp., Tulsa, will become AIME president-elect. New vice presidents of the association include **John S. Bell,** Humble Oil & Refining Co., Houston, and **Wayne E. Glenn,** Continental Oil Co., Houston. Glenn is currently president of AIME's Society of Petroleum Engineers and Bell is a former SPE president. **Robert B. Gilmore,** DeGolyer & McNaughton, has been elected a director of AIME.

# ▶▶▶ Personals

**H. Nelson VerSoy,** manager of H. C. Price Co.'s Gulf division in Harvey, La., has been promoted to general superintendent of the pipe-coating division. He will headquarter in the Bartlesville, Okla., home office. **Leo C. Carle,** assistant Gulf division manager, will succeed VerSoy as manager. **Vernon J. Jones,** foreman, has been promoted to plant superintendent in Harvey. VerSoy has been with the company since 1942. He was appointed Gulf division manager in 1951.

VERSOY

**H. R. Knauth,** superintendent for Tidal Pipe Line Co., has moved his headquarters to Kilgore, Tex., from Joinerville, Tex.

**Carl D. Hall,** Boston division sales manager for Texaco Inc., has been named assistant general sales manager, merchandising, in New York. **Thomas F. Walsh,** assistant division sales manager in Boston will succeed Hall there. **Frank J. Novak,** Indianapolis division sales manager, has been appointed assistant general sales manager for the central region, Chicago. **William M. Fisher,** assistant division sales manager in Indianapolis, will succeed Novak.

**Dale M. Robinson,** district drilling and production foreman for Atlantic Refining Co. in Great Bend, Kans., has joined Pickrell Drilling Co. in Wichita as chief engineer and manager of production.

**C. A. Hardy,** field engineer with Texaco Inc., has been transferred to Penwell, Tex., from Big Spring, Tex.

**Tom Lee,** engineer and supervisor for Ross Drilling Co., has been transferred to El Paso, Tex., from Hermosa Beach, Calif.

**J. R. Riggs,** manager of procedures for Kerr-McGee Oil Industries, Inc., in Oklahoma City, has joined Socony Mobil Oil Co., Inc., as methods-research project manager in Dallas.

**W. D. Hill, Jr.,** has been named associate in the development department of Monsanto Chemical Co.'s plastics divisions, Springfield, Mass. **T. M. Reymont** has joined the research department of Monsanto's plastics division plant in Texas City.

**George H. Supple,** manager of West Coast pipelines of Mobil Oil Co. in Los Angeles, will retire December 31 after 36 years with the company. He will be succeeded by **John S. Black,** president of South Saskatchewan Pipe Lines, Ltd., an affiliate. Black will act as assistant manager in Los Angeles until Supple's retirement.

**S. W. Ogan,** general superintendent of operations for Continental Pipe Line Co. in Ponca City, Okla., has been promoted to manager of construction, a new position. He will be succeeded by **R. E. Lombard,** Oklahoma-Kansas-Illinois district superintendent. **T. W. Sigler,** assistant superintendent of the Oklahoma-Kansas-Illinois district, has been promoted to manager of new plans and projects. **W. E. Laughlin,** Louisiana district superintendent, Lake Charles, has been named administrative coordinator, a new position. **W. F. Burke,** Rocky Mountain district superintendent, Casper, Wyo., has been promoted to Oklahoma-Kansas-Illinois superintendent, succeeding Lombard. Burke will be succeeded by **R. W. Lee,** temporary North Texas district superintendent in Wichita Falls. **W. P. Ilgen, Jr.,** Spokane, Wash., assistant superintendent of Yellowstone Pipe Line Co., a Continental affiliate, has been named to succeed Laughlin as Louisiana superintendent. **J. L. Walker,** East Alton, Ill., assistant superintendent of Cherokee Pipe Line Co., an affiliate, will succeed Lee in Wichita Falls.

**K. E. Rotegard,** financial and services coordinator for Gulf Oil Corp.'s domestic production, has been named manager of the new domestic-services department, Houston. The department represents a new management approach to certain company functions which formerly have been handled either separately or under a variety of departments. Under domestic services will be such operations as data processing, employe relations, insurance, law, public relations, purchasing, tax, treasury, and office services of the Houston operating headquarters.

**David E. A. Johnson,** consulting petroleum engineer, has moved his offices to Denver from Farmington, N. M.

**Raymond B. Kelly,** vice president and a director of Pure Oil Co., has been transferred from Chicago to Fort Worth, where he will act as consultant on company field operations.

**A. E. McCort,** assistant district pipeline superintendent for Panhandle Eastern Pipe Line Co., has been transferred to Jackson, Mich., from Elkhart, Kans. **M. E. Shaw** has joined Panhandle Eastern as petroleum engineer in Liberal, Kansas.

**Kenneth T. White,** vice president in charge of Warren Petroleum Corp.'s liquefied petroleum gas division, has been elected a director of the company. White will continue as vice president, a post he has held since 1958. Before that time, he held several district assignments, served as LPG division sales manager from 1954-57, and as general manager of the division in 1957.

**Ralph J. Schilthuis,** executive vice president of Humble Oil & Refining Co.'s Humble division, will receive the 1960 AIME John Franklin Carll award at the association's annual meeting October 2-5 in Denver. The Carll award, presented by the Society of Petroleum Engineers, recognizes outstanding achievements in petroleum engineering.

**Richard L. Ryan,** district superintendent for Panhandle Eastern Pipe Line Co.'s Maumee, Ohio, pipeline district, has been transferred to Glenarm, Ill., in the same capacity. **Guy M. McElfresh,** assistant in Maumee, has succeeded Ryan there. **Carl L. Fennewald,** Zionsville, Ind., has moved to Maumee to succeed McElfresh.

**J. M. Landreneau,** district superintendent for Continental Oil Co., has been transferred to Pleasanton, Tex., from Yorktown, Tex.

**Donald Sutton,** geologist with Sun Oil Co., has been transferred to Mount Pleasant, Mich., from Beaumont, Tex.

**Alvin J. Pearson,** senior reservoir engineer for Atlantic Refining Co., has joined the oil and public utilities loan division of Continental Illinois National Bank & Trust Co., Chicago, as a petroleum engineer.

**Tilden Cummings,** president and a director of Continental Illinois National Bank & Trust Co. of Chicago, has been elected a director of Northern Natural Gas Co. His election brings total Northern board membership to eight.

## ▶ ▶ ▶ Deaths

**Whitney M. Elias,** 49, production vice president of Pan American Petroleum Corp., Tulsa, died of a heart attack early September 22 in Paris. Elias was one of eight U. S. oil men who toured Russia in August. He had gone on to inspect Pan Am operations in the Middle East and at the time of his death was vacationing in Europe with his wife. He was preparing to leave for London en route home when the attack occurred. Elais joined Pan Am in 1935 soon after leaving college. He became a vice president, director, and division manager in Houston in 1956 and in 1959 moved to Tulsa as vice president in charge of production. He was a member of a number of oil organizations and was a former director of the Louisiana-Arkansas division of the Mid-Continent Oil and Gas Association. In Houston he was a director of the Bank of the Southwest and in Tulsa a trustee of Hillcrest Medical Center.

**R. L. McMillon,** 51, McAllen, Tex., construction vice president of Western Pipe Line, Inc., and **Roy J. Ray,** 51, Owensboro, Ky., chief inspector for Texas Gas Transmission Corp., were killed September 18 when their private plane crashed near Bedford, Ind. The men were inspecting construction of a new Texas Gas line in the area. Western is contractor. The plane dipped too low over the project, hit two 66,000-volt power lines, and crashed.

**Darst Eugene (Buck) Buchanan,** 68, president of Hiwan Oil & Gas Co., Englewood, Colo., and founder of the old Hanlon - Buchanan, Inc., Tulsa, died September 15 in a Denver hospital after a heart attack. Buchanan was president of Hanlon-Buchanan, pioneer firm in the natural-gasoline industry, for 27 years before its sale to Warren Petroleum Corp. in 1946. He formed Hiwan later that year. Buchanan was an organizer of Natural Gasoline Association of America and served as its second president. In 1953 he received the Hanlon award, top NGAA honor. He served as a director of American Petroleum Institute for 20 years and was head of API's membership committee for 10 years.

**W. R. Ryburn,** former sales manager of tubular products for National Supply Co., died recently in Evanston, Ill.

**Herbert W. Ladd., Sr.,** 64, superintendent of materials for Pan American Petroleum Corp., died September 18 at his home in Tulsa of cancer. Ladd was a former chairman of API's Mid-Continent district and was chairman of the API central committee on standardization of equipment for several years.

**Percy D. Clay,** 60, analyst and consultant with Richfield Oil Corp., died September 9 in a Los Angeles hospital.

**George Hartt Johnson,** 90, pioneer California independent operator, died September 17 in a Hollywood, Calif., hospital.

**Maynard Smith,** 47, partner in Smith & Smith, producing firm with offices in Wharton, Tex., and Houston, died September 13 in Wharton after a heart attack.

**Carl C. Crenshaw,** 47, assistant to the manager of Phillips Petroleum Co.'s land and geological department, Bartlesville, Okla., died September 17 in a Bartlesville hospital. He had been with Phillips since 1935.


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| Stores: | | Sales Offices: | Pipe Yards: |
|---|---|---|---|
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| Kamay | Olney | Midland | Houston, Texas |
| Wichita Falls | Snyder | Houston | Lone Star, Texas |
| | | | Pueblo, Colorado |

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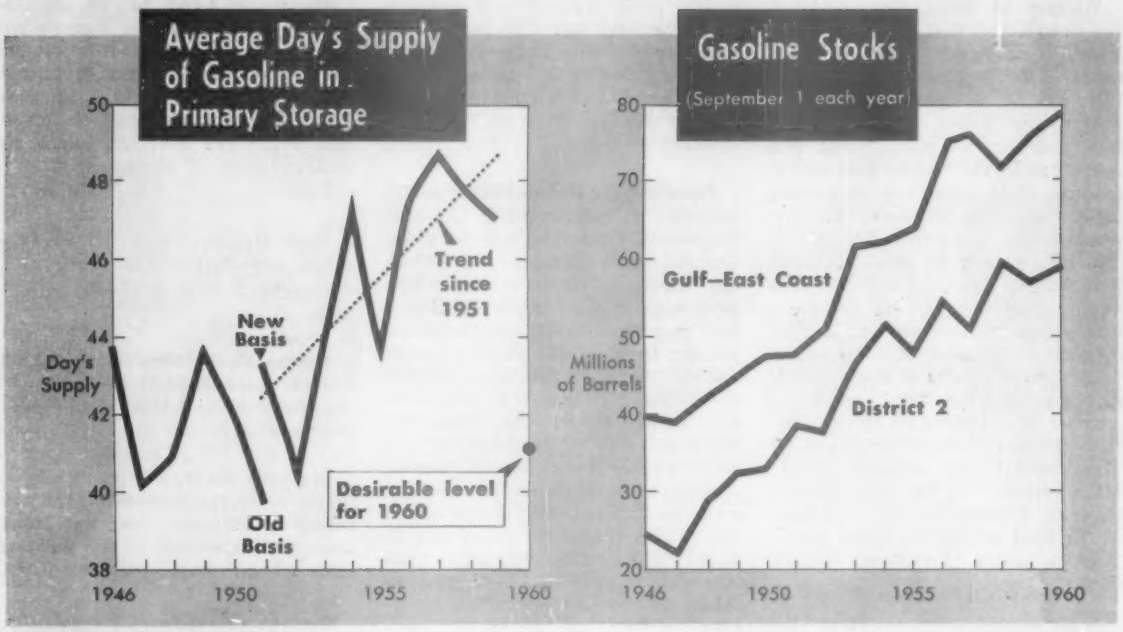



# Gasoline surplus is a year-round problem

BY JOHN C. CASPER

GASOLINE STOCKS have been growing faster than demand, but this is not a new or changed condition for the oil industry. The stock-demand ratio has been increasing for several years.

Midsummer stocks have been above desirable levels since 1952 (OGJ, Sept. 19, p. 61). But the stock overage has not been confined to spring and summer seasons. It has shown up in all seasons of the year.

Take a look at the first of the above charts. It shows that average monthly stocks have been climbing faster than demand, at least since 1951.

Starting with 1951, inventory reports to the Bureau of Mines included more terminal stocks than in prior years. This shift accounts for the break in the line.

Points on the broken line represent day's supply of gasoline each year. The average of month-end gasoline inventories for a given year was divided by daily average gasoline demand for the year. The result gives an idea of the relationship between stocks and demand.

The straight line is a calculated trend for the period 1951-59. It shows that stocks have increased more than enough to cover increase in demand. In fact, refiners have added enough stocks each year to supply about three-fourths of a day's demand over and above additions to cover normal demand gains.

This program of running a little extra gasoline to storage each year has raised the general gasoline inventory level to point where even a mild slowdown in gasoline demand may put pressure on gasoline prices.

Lines on the second chart show gasoline stock gains in District 2 and in the Gulf-East Coast area. District 2 stocks on September 2 this year were two and a half times the total at the end of World War II.

Here is another fact to keep in mind when you are studying gasoline figures over the next few weeks. Late September demand last year was inflated by prebuying before the extra cent was added to the federal gasoline tax on October 1. As a result, gasoline stocks decreased 7,793,000 bbl. in September last year to set an all-time record for the month.

On the other hand, don't be surprised by good year-to-year gains in demand for early October. It took a couple of weeks in early October last year to work off the extra gasoline delivered in late September.

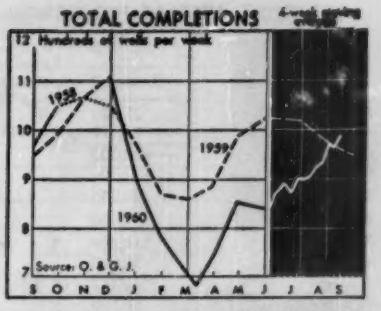
## A quick look at the highlights . . .

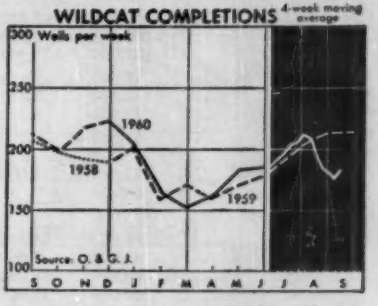
| | LATEST WEEK | Change from WEEK AGO | | Change from YEAR AGO | |
|---|---|---|---|---|---|
| Production | 6,862,340 | DOWN | 33,320 | UP | 10,107 |
| Crude stocks | 227,787,000 | DOWN | 4,782,000 | DOWN | 21,368,000 |
| Completions | 957 | DOWN | 6 | UP | 72 |
| Refinery runs | 8,083,000 | DOWN | 196,000 | UP | 89,000 |
| Gasoline stocks | 189,345,000 | UP | 469,000 | UP | 8,563,000 |
| Kerosine stocks | 34,704,000 | UP | 183,000 | UP | 2,218,000 |
| Distillate stocks | 162,773,000 | UP | 3,665,000 | DOWN | 7,480,000 |
| Residual stocks | 47,633,000 | DOWN | 160,000 | DOWN | 10,534,000 |
| Four-product stocks | 434,455,000 | UP | 4,147,000 | DOWN | 7,233,000 |
| Total imports | 1,611,500 | UP | 229,700 | UP | 219,600 |

# Active Rotary Rigs

| | 9-19-60 | 9-12-60 | 9-21-59 |
|---|---|---|---|
| Alabama | 3 | 4 | 8 |
| Alaska | 7 | 7 | (†) |
| Arkansas | 13 | 9 | 17 |
| Arizona | 1 | 1 | 1 |
| California | 81 | 83 | 89 |
| Land | 78 | 81 | 85 |
| Offshore | 3 | 2 | 4 |
| Colorado | 51 | 50 | 61 |
| Florida | 1 | 2 | 2 |
| Land | 1 | 2 | 2 |
| Offshore | 0 | 0 | 0 |
| Illinois | 50 | 44 | 48 |
| Indiana | 7 | 8 | 7 |
| Iowa | 0 | 0 | 2 |
| Kansas | 120 | 116 | 133 |
| Kentucky | 5 | 6 | 10 |
| Louisiana | 284 | 280 | 329 |
| North | 36 | 33 | 36 |
| S. Inland waters | 112 | 113 | 123 |
| S. Land | 82 | 80 | 112 |
| Offshore | 54 | 54 | 58 |
| Maryland | 0 | 1 | 0 |
| Michigan | 36 | 36 | 33 |
| Mississippi | 51 | 52 | 77 |
| Missouri | 2 | 2 | 0 |
| Montana | 25 | 24 | 26 |
| Nebraska | 21 | 25 | 25 |
| Nevada | 2 | 1 | 1 |
| New Mexico | 105 | 114 | 112 |
| New York | 2 | 2 | 0 |
| North Dakota | 14 | 15 | 26 |
| Ohio | 6 | 7 | 5 |
| Oklahoma | 170 | 150 | 223 |
| Oregon | 1 | 1 | 0 |
| Pennsylvania | 8 | 7 | 8 |
| South Dakota | 1 | 1 | 8 |
| Texas | 616 | 566 | 754 |
| S. Inland waters | 3 | 3 | 6 |
| S. Land | 174 | 143 | 192 |
| Offshore | 1 | 1 | 0 |
| North | 43 | 47 | 166 |
| Panhandle | 49 | 50 | (*) |
| East | 56 | 49 | (*) |
| West Central | 174 | 166 | 247 |
| West | 116 | 107 | 143 |
| Utah | 29 | 29 | 30 |
| Washington | 1 | 1 | 2 |
| West Virginia | 6 | 6 | 5 |
| Wyoming | 69 | 64 | 90 |
| Total U. S. | 1,788 | 1,714 | 2,132 |
| Western Canada | 135 | 147 | 178 |
| Eastern Canada | 0 | 1 | 1 |
| Grand total | 1,923 | 1,862 | 2,311 |

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60.




## WEEKLY WELL COMPLETIONS . . . WEEK ENDED SEPTEMBER 17, 1960

| | Total wells | | | | | | | Cum. | | Total wildcats | | | | | Cum. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Crude | Cond. | Gas | Dry | Service | Footage | 1960 | 1959 | Total | Crude | Cond. | Gas | Dry | 1960 | 1959 |
| Alabama | 1 | 1 | 0 | 0 | 0 | 0 | 11,332 | 33 | 70 | 0 | 0 | 0 | 0 | 0 | 2 | 20 |
| Arizona | 2 | 0 | 0 | 0 | 2 | 0 | 2,114 | 28 | ..... | 0 | 0 | 0 | 0 | 0 | 18 | ..... |
| Arkansas | 15 | 6 | 1 | 3 | 5 | 0 | 74,257 | 425 | 590 | 2 | 0 | 0 | 1 | 1 | 114 | 104 |
| California | 29 | 19 | 0 | 3 | 7 | 0 | 129,215 | 1,153 | 1,083 | 3 | 0 | 0 | 0 | 3 | 220 | 277 |
| Colorado | 18 | 3 | 0 | 5 | 10 | 0 | 86,022 | 453 | 255 | 7 | 0 | 0 | 0 | 7 | 227 | 332 |
| Illinois | 58 | 19 | 0 | 0 | 14 | 25 | 123,411 | 1,591 | 1,613 | 13 | 2 | 0 | 0 | 11 | 325 | 274 |
| Indiana | 37 | 11 | 0 | 0 | 26 | 0 | 42,089 | 745 | 588 | 14 | 0 | 0 | 0 | 14 | 272 | 198 |
| Kansas | 126 | 71 | 0 | 5 | 49 | 1 | 299,341 | 2,591 | 2,888 | 30 | 6 | 0 | 3 | 21 | 740 | 714 |
| Kentucky | 81 | 12 | 0 | 2 | 15 | 52 | 77,642 | 1,449 | 1,750 | 7 | 1 | 0 | 1 | 5 | 125 | 188 |
| Louisiana | 62 | 32 | 6 | 5 | 17 | 1 | 451,991 | 2,511 | 2,647 | 7 | 0 | 0 | 0 | 7 | 392 | 359 |
| North | 23 | 12 | 0 | 3 | 7 | 1 | 79,622 | 939 | 1,015 | 4 | 0 | 0 | 0 | 4 | 189 | 156 |
| South | 30 | 14 | 4 | 2 | 10 | 0 | 296,246 | 1,216 | 1,342 | 3 | 0 | 0 | 0 | 3 | 178 | 189 |
| Offshore | 8 | 6 | 2 | 0 | 0 | 0 | 76,123 | 356 | 290 | 0 | 0 | 0 | 0 | 0 | 25 | 14 |
| Michigan | 31 | 4 | 0 | 1 | 11 | 15 | 78,990 | 657 | 456 | 6 | 0 | 0 | 0 | 6 | 169 | 116 |
| Mississippi | 14 | 5 | 0 | 1 | 8 | 0 | 130,080 | 497 | 450 | 8 | 2 | 0 | 0 | 6 | 191 | 203 |
| Montana | 7 | 1 | 0 | 1 | 5 | 0 | 24,278 | 221 | 230 | 4 | 0 | 0 | 1 | 3 | 105 | 72 |
| Nebraska | 10 | 1 | 0 | 0 | 9 | 0 | 51,505 | 627 | 634 | 5 | 0 | 0 | 0 | 5 | 254 | 265 |
| New Mexico | 38 | 17 | 1 | 11 | 9 | 0 | 201,924 | 1,316 | 1,470 | 5 | 1 | 0 | 0 | 4 | 198 | 170 |
| West | 17 | 6 | 0 | 10 | 1 | 0 | 92,486 | 446 | 665 | 2 | 1 | 0 | 0 | 1 | 50 | 45 |
| East | 21 | 11 | 1 | 1 | 8 | 0 | 109,438 | 870 | 805 | 3 | 0 | 0 | 0 | 3 | 148 | 125 |
| New York | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 232 | 195 | 0 | 0 | 0 | 0 | 0 | 33 | 18 |
| North Dakota | 8 | 4 | 0 | 0 | 4 | 0 | 57,612 | 213 | 344 | 3 | 1 | 0 | 0 | 2 | 57 | 65 |
| Ohio | 20 | 10 | 0 | 0 | 7 | 3 | 40,661 | 754 | 713 | 0 | 0 | 0 | 0 | 0 | 36 | 23 |
| Oklahoma | 87 | 47 | 0 | 6 | 22 | 12 | 341,403 | 3,339 | 4,061 | 6 | 2 | 0 | 1 | 3 | 540 | 618 |
| Pennsylvania | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 440 | 392 | 0 | 0 | 0 | 0 | 0 | 8 | 10 |
| South Dakota | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | ..... | 0 | 0 | 0 | 0 | 0 | 7 | ..... |
| Texas | 273 | 130 | 18 | 8 | 111 | 6 | 1,051,635 | 11,212 | 13,593 | 53 | 3 | 1 | 1 | 48 | 2,312 | 2,566 |
| District 1 | 29 | 14 | 0 | 0 | 14 | 1 | 60,215 | 775 | 780 | 10 | 0 | 0 | 0 | 10 | 291 | 226 |
| District 2 | 14 | 3 | 3 | 2 | 6 | 0 | 97,119 | 553 | 567 | 4 | 0 | 1 | 0 | 3 | 140 | 171 |
| District 3 | 10 | 3 | 0 | 1 | 6 | 0 | 66,835 | 852 | 859 | 1 | 0 | 0 | 0 | 1 | 159 | 177 |
| District 4 | 18 | 3 | 1 | 2 | 11 | 1 | 83,914 | 778 | 966 | 5 | 0 | 0 | 0 | 5 | 222 | 239 |
| East | 12 | 5 | 2 | 0 | 5 | 0 | 60,758 | 899 | 884 | 3 | 0 | 0 | 0 | 3 | 186 | 172 |
| District 7-B | 50 | 28 | 5 | 1 | 16 | 0 | 122,008 | 1,641 | 1,849 | 14 | 2 | 0 | 1 | 11 | 472 | 493 |
| West | 78 | 45 | 5 | 0 | 24 | 4 | 388,427 | 2,945 | 4,189 | 11 | 1 | 0 | 0 | 10 | 455 | 579 |
| District 9 | 50 | 23 | 0 | 0 | 27 | 0 | 121,889 | 2,042 | 2,562 | 5 | 0 | 0 | 0 | 5 | 344 | 434 |
| District 10 | 12 | 6 | 2 | 2 | 2 | 0 | 50,470 | 727 | 937 | 0 | 0 | 0 | 0 | 0 | 43 | 75 |
| Utah | 4 | 1 | 0 | 0 | 3 | 0 | 23,937 | 173 | 222 | 2 | 0 | 0 | 0 | 2 | 59 | 58 |
| West Virginia | 16 | 3 | 0 | 13 | 0 | 0 | 34,194 | 579 | 561 | 0 | 0 | 0 | 0 | 0 | 6 | 23 |
| Wyoming | 23 | 13 | 1 | 1 | 8 | 0 | 120,046 | 746 | 708 | 8 | 0 | 1 | 1 | 6 | 304 | 243 |
| Miscellaneous | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 | 102 | 0 | 0 | 0 | 0 | 0 | 95 | 67 |
| Total U. S. | 959 | 410 | 27 | 65 | 342 | 115 | 3,453,679 | 32,108 | 35,915 | 183 | 18 | 2 | 9 | 154 | 6,809 | 6,983 |
| Prev. week | 961 | 423 | 34 | 79 | 324 | 101 | 3,780,715 | ..... | ..... | 175 | 19 | 3 | 11 | 142 | ..... | ..... |
| Cum. 1960 | 32,108 | 14,588 | 946 | 2,616 | 12,252 | 1,706 | 135,060,430 | ..... | ..... | 6,809 | 602 | 76 | 229 | 5,902 | ..... | ..... |
| Cum. 1959 | 35,915 | 18,013 | 875 | 2,642 | 13,458 | 927 | 149,487,410 | ..... | ..... | 6,983 | 649 | 90 | 224 | 6,020 | ..... | ..... |
| Western Canada | 32 | 18 | 0 | 4 | 9 | 1 | 160,924 | 1,655 | 1,749 | 7 | 0 | 0 | 1 | 6 | 436 | 491 |

## PRODUCTION

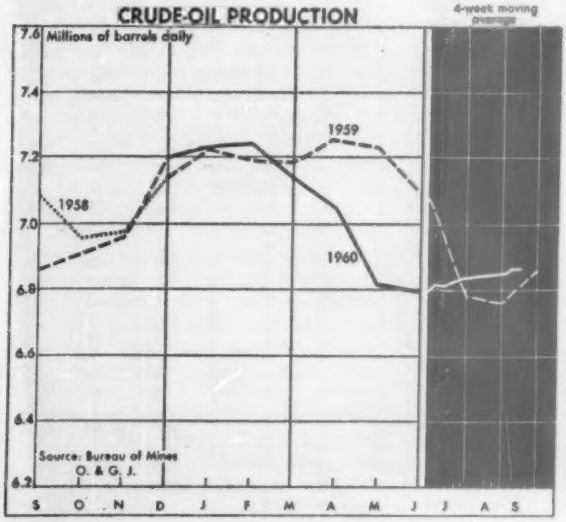
### DAILY AVERAGE PRODUCTION FOR WEEK

| | September 17, 1960 | | | |
|---|---|---|---|---|
| | Crude oil | Lease condensate | Total | Sept. 10 total |
| Alabama | 21,500 | ..... | 21,500 | 21,000 |
| Arkansas | 77,150 | 175 | 77,325 | 80,150 |
| California | 829,000 | ..... | 829,000 | 834,000 |
| Colorado | 132,300 | ..... | 132,300 | 132,100 |
| Eastern | 40,700 | ..... | 40,700 | 41,600 |
| Florida | 900 | ..... | 900 | 900 |
| Illinois | 218,500 | ..... | 218,500 | 214,900 |
| Indiana | 32,100 | ..... | 32,100 | 31,500 |
| Kansas | †294,515 | ..... | †294,515 | †296,510 |
| Kentucky | 60,100 | ..... | 60,100 | 59,700 |
| Louisiana | 952,500 | 123,450 | 1,075,950 | 1,075,900 |
| North | 105,500 | 5,950 | 111,450 | 111,400 |
| South | 847,000 | 117,500 | 964,500 | 964,500 |
| Michigan | 41,900 | ..... | 41,900 | 41,800 |
| Mississippi | 132,000 | 3,550 | 135,550 | 135,550 |
| Montana | 82,500 | ..... | 82,500 | 83,100 |
| Nebraska | 65,500 | ..... | 65,500 | 65,400 |
| Nevada | 100 | ..... | 100 | 100 |
| New Mexico | 287,500 | 8,000 | 295,500 | 295,500 |
| North Dakota | 64,700 | ..... | 64,700 | 66,400 |
| Oklahoma | †475,000 | ..... | †475,500 | †502,600 |
| Texas | 2,380,000 | 81,500 | 2,461,500 | 2,461,500 |
| Dist. 1 | 42,000 | 2,500 | 44,599 | 44,500 |
| Dist. 2 | 98,000 | 8,000 | 106,000 | 106,000 |
| Dist. 3 | 306,000 | 36,000 | 342,000 | 342,000 |
| Dist. 4 | 171,000 | 12,200 | 183,200 | 183,200 |
| Dist. 5 | 26,000 | 300 | 26,300 | 26,300 |
| Dist. 6 | 109,000 | 9,800 | 118,800 | 118,800 |
| East Texas field | 124,000 | ..... | 124,000 | 124,000 |
| Dist. 7-B | 129,000 | 125 | 129,125 | 129,125 |
| Dist. 7-C | 113,000 | 3,050 | 116,050 | 116,050 |
| Dist. 8 | 960,000 | 7,000 | 967,000 | 967,000 |
| Dist. 9 | 195,000 | 1,600 | 196,600 | 196,600 |
| Dist. 10 | 107,000 | 925 | 107,925 | 107,925 |
| Utah | 96,900 | ..... | 96,900 | 94,200 |
| Wyoming | 358,200 | ..... | 358,200 | 359,600 |
| Others | ‡1,600 | ..... | ‡1,600 | ‡1,650 |
| Total U. S. | 6,645,665 | 216,675 | 6,862,340 | 6,895,660 |
| Change from prev. week, down | | | 33,320 | |
| Canada | †539,500 | ..... | †539,500 | †446,600 |

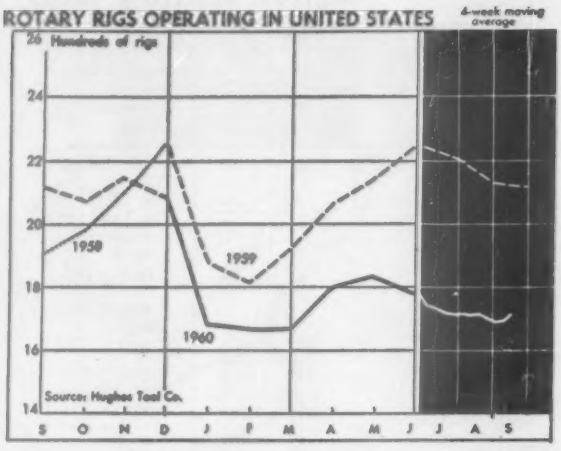
Total U. S. Prod., January 1-September 17 ..... 1,827,672,500 bbl.
Same period last year (crude plus cond.) ..... *1,838,672,300 bbl.

*Includes 48,583,200 bbl. condensate. †Week ended previous Monday. ‡Alaska, South Dakota, and Arizona.

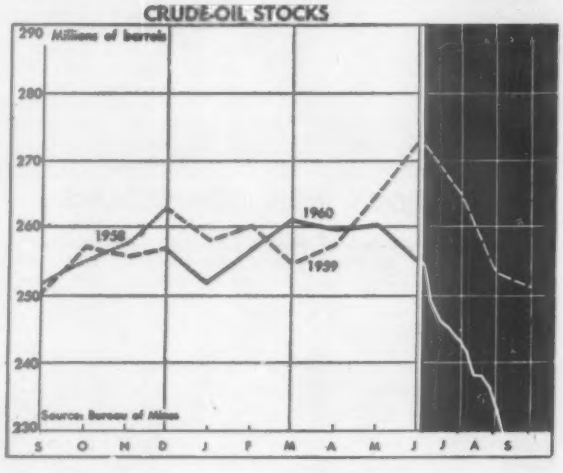
### CRUDE-OIL PRODUCTION




### ROTARY RIGS OPERATING IN UNITED STATES



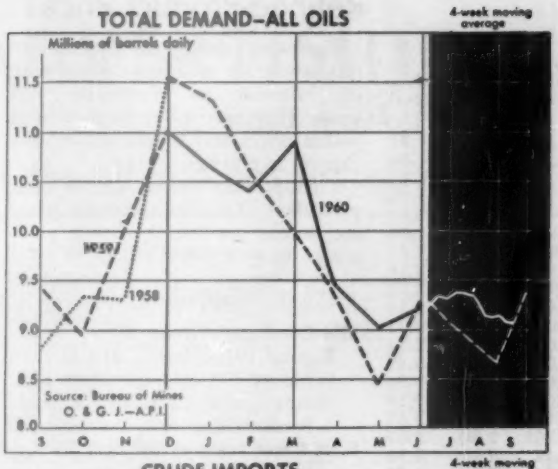

### CRUDE-OIL STOCKS

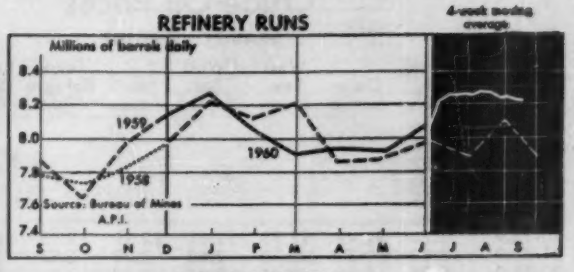


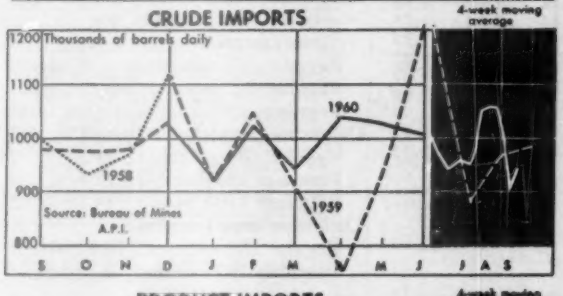

### CRUDE-OIL STOCKS BY STATES OF ORIGIN*
(Thousands of barrels)

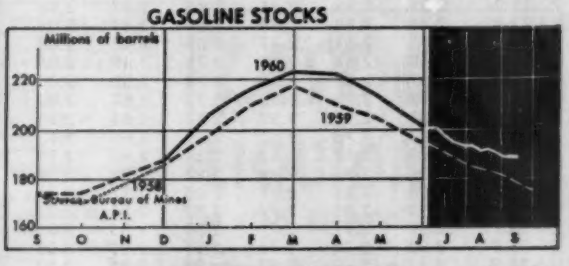
| | 9-10-60 | 9-3-60 | 9-12-59 |
|---|---|---|---|
| Pennsylvania | 2,312 | 2,323 | 2,691 |
| Other Appalachian | 1,473 | 1,511 | 2,033 |
| Illinois, Indiana, Michigan | 9,029 | 9,253 | 9,455 |
| Nebraska and North Dakota | 2,813 | 2,855 | 2,668 |
| Kansas | 8,658 | 8,679 | 10,003 |
| Oklahoma | 14,793 | 14,938 | 14,769 |
| Arkansas | 1,900 | 1,855 | 2,001 |
| Louisiana | 18,056 | 18,341 | 17,768 |
| North | 2,975 | 2,908 | 3,383 |
| South | 15,081 | 15,433 | 14,385 |
| Mississippi, Alabama, Florida | 1,896 | 2,036 | 2,604 |
| New Mexico | 7,927 | 7,836 | 7,697 |
| Texas | 96,918 | 98,034 | 106,254 |
| East Texas | 7,727 | 7,792 | 8,758 |
| West Texas | 46,690 | 46,847 | 48,471 |
| Texas Gulf | 16,101 | 16,333 | 18,205 |
| Other Texas | 26,400 | 27,062 | 30,820 |
| Wyoming | 14,403 | 14,893 | 15,923 |
| Other Rocky Mountain | 9,345 | 9,664 | 9,366 |
| California | 26,095 | 26,699 | 30,219 |
| Foreign | †12,169 | 13,652 | 15,704 |
| Total | 227,787 | 232,569 | 249,155 |

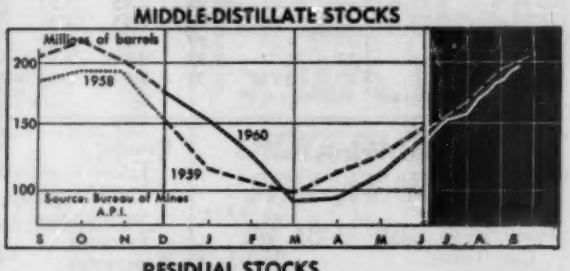
*Bureau of Mines. †Includes 3,676,000 bbl. in California.

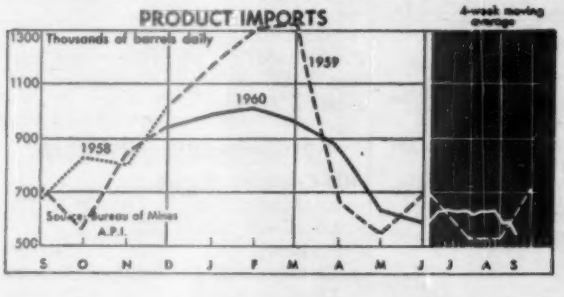


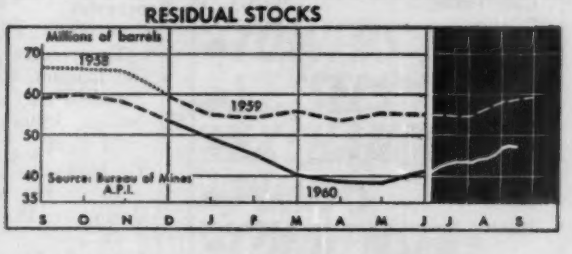




## API REFINERY REPORT, SEPTEMBER 16, 1960

(Thousands of barrels)

| District— | Daily avg. runs | Daily average production Gaso.* | Kero. | Dist. | Resid. | Stocks‡ Gaso.† | Kero. | Dist. | Resid. | Bureau of Mines, September 1959 Daily avg. runs | Daily average production Gaso.* | Kero. | Dist. | Resid. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East Coast | 1,123 | 476.7 | 27.6 | 285.4 | 140.0 | 43,762 | 13,645 | 60,308 | 12,175 | 1,065 | 520.0 | 30.8 | 321.1 | 151.0 |
| Appalachian: | | | | | | | | | | | | | | |
| District 1 | 94 | 42.1 | 3.9 | 24.3 | 5.0 | 5,667 | 819 | 4,061 | 460 | 97 | 41.8 | 2.6 | 21.4 | 6.2 |
| District 2 | 105 | 56.1 | 6.6 | 20.4 | 10.0 | 3,059 | 464 | 1,637 | 296 | 96 | 52.9 | 5.6 | 16.8 | 6.2 |
| Ind., Ill., Ky. | 1,478 | 809.0 | 56.8 | 346.9 | 141.6 | 32,541 | 7,263 | 28,647 | 5,772 | 1,441 | 775.5 | 61.5 | 298.0 | 135.9 |
| Minn., Wis., Dak. | 118 | 54.6 | 5.1 | 27.9 | 16.7 | 6,190 | 1,561 | 8,119 | 603 | 104 | 49.6 | 4.6 | 27.0 | 11.0 |
| Okla., Kans., Mo. | 747 | 411.9 | 10.3 | 180.4 | 23.4 | 16,969 | 1,902 | 14,015 | 918 | 737 | 412.0 | 8.8 | 189.4 | 22.1 |
| Inland Texas | 296 | 232.9 | 8.9 | 42.1 | 16.1 | 6,711 | 633 | 1,565 | 2,533 | 276 | 217.7 | 7.1 | 47.9 | 21.0 |
| Texas Gulf Coast | 1,873 | 998.7 | 140.4 | 472.4 | 119.4 | 25,603 | 3,659 | 17,616 | 5,855 | 1,795 | 911.7 | 86.9 | 420.1 | 138.8 |
| La. Gulf Coast | 627 | 398.7 | 73.8 | 136.3 | 43.7 | 11,408 | 1,995 | 7,334 | 1,426 | 706 | 377.7 | 61.1 | 147.8 | 49.2 |
| N. La. and Ark. | 113 | 76.7 | 9.7 | 20.1 | 9.9 | 4,791 | 1,003 | 2,246 | 138 | 73 | 33.5 | 3.1 | 13.9 | 5.4 |
| Rocky Mountain: | | | | | | | | | | | | | | |
| New Mexico | 26 | 12.7 | 0.3 | 4.9 | 3.4 | 588 | 48 | 159 | 9 | 23 | 12.1 | 0.2 | 4.4 | 2.1 |
| Other Rocky Mt. | 297 | 135.3 | 5.4 | 60.1 | 33.6 | 5,090 | 390 | 2,863 | 1,045 | 305 | 145.9 | 3.3 | 61.7 | 32.3 |
| West Coast | 1,186 | 489.6 | 18.3 | 221.1 | 253.1 | 26,966 | 1,322 | 14,203 | 16,403 | 1,160 | 521.8 | 1.2 | 175.7 | 271.5 |
| Sept. 16, 1960 | 8,083 | 4,195.0 | 366.7 | 1,842.3 | 815.9 | 189,345 | 34,704 | 162,773 | 47,633 | 7,878 | 4,072.2 | 276.8 | 1,745.2 | 852.7 |
| Sept. 9, 1960 | 8,271 | 4,286.0 | 397.6 | 1,849.0 | 892.9 | 188,886 | 34,521 | 159,108 | 47,793 | ..... | ..... | ..... | ..... | ..... |
| Sept. 18, 1959 | 7,994 | 4,170.3 | 259.6 | 1,760.9 | 868.9 | 180,782 | 32,486 | 170,253 | 58,167 | ..... | ..... | ..... | ..... | ..... |

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

# Crude-Oil Prices

GRAVITY SCHEDULE

| | Signal Hill, Calif. | Oklahoma | West Tex. (sour) | West Tex. (Inter.) | No.* Texas | Texas Refugio Light | Bayou Sale (La.) | Denver Julesburg | Wyo. (sour) |
|---|---|---|---|---|---|---|---|---|---|
| 14-14.9 | $1.76 | .... | .... | .... | .... | .... | .... | .... | .... |
| 15-15.9 | 1.84 | .... | .... | .... | .... | .... | .... | .... | $1.81 |
| 16-16.9 | 1.92 | .... | .... | .... | .... | .... | .... | .... | 1.86 |
| 17-17.9 | 2.00 | .... | .... | .... | .... | .... | .... | .... | 1.91 |
| 18-18.9 | 2.08 | .... | .... | .... | .... | .... | .... | .... | 1.96 |
| 19-19.9 | 2.16 | .... | .... | .... | .... | .... | .... | .... | 2.01 |
| 20-20.9 | 2.24 | $2.49 | $2.35 | $2.61 | $2.29 | $2.95 | $2.90 | $2.58 | 2.06 |
| 21-21.9 | 2.32 | 2.52 | 2.38 | 2.63 | 2.33 | 2.97 | 2.92 | 2.60 | 2.11 |
| 22-22.9 | 2.39 | 2.55 | 2.41 | 2.65 | 2.37 | 2.99 | 2.94 | 2.62 | 2.16 |
| 23-23.9 | 2.46 | 2.58 | 2.44 | 2.67 | 2.41 | 3.01 | 2.96 | 2.64 | 2.21 |
| 24-24.9 | 2.53 | 2.61 | 2.47 | 2.69 | 2.45 | 3.03 | 2.98 | 2.66 | 2.26 |
| 25-25.9 | 2.60 | 2.64 | 2.50 | 2.71 | 2.49 | 3.05 | 3.00 | 2.68 | 2.31 |
| 26-26.9 | 2.67 | 2.67 | 2.53 | 2.73 | 2.53 | 3.07 | 3.02 | 2.70 | 2.36 |
| 27-27.9 | 2.74 | 2.70 | 2.56 | 2.75 | 2.57 | 3.09 | 3.04 | 2.72 | 2.49 |
| 28-28.9 | 2.81 | 2.73 | 2.59 | 2.77 | 2.61 | 3.11 | 3.06 | 2.74 | 2.54 |
| 29-29.9 | 2.87 | 2.76 | 2.62 | 2.79 | 2.65 | 3.13 | 3.08 | 2.76 | 2.59 |
| 30-30.9 | 2.93 | 2.79 | 2.65 | 2.81 | 2.69 | 3.15 | 3.10 | 2.78 | 2.63 |
| 31-31.9 | 3.00 | 2.82 | 2.68 | 2.83 | 2.73 | 3.17 | 3.12 | 2.80 | 2.67 |
| 32-32.9 | 3.06 | 2.85 | 2.71 | 2.85 | 2.77 | 3.19 | 3.14 | 2.82 | 2.71 |
| 33-33.9 | 3.12 | 2.88 | 2.74 | 2.87 | 2.81 | 3.21 | 3.16 | 2.84 | 2.75 |
| 34-34.9 | 3.17 | 2.91 | 2.77 | 2.89 | 2.85 | 3.23 | 3.18 | 2.86 | 2.79 |
| 35-35.9 | 3.22 | 2.94 | 2.80 | 2.91 | 2.89 | 3.25 | 3.20 | 2.88 | 2.83 |
| 36-36.9 | 3.27 | 2.97 | 2.83 | 2.93 | 2.93 | 3.27 | 3.22 | 2.90 | 2.87 |
| 37-37.9 | 3.31 | 2.99 | 2.86 | 2.95 | 2.95 | 3.29 | 3.24 | 2.92 | 2.89 |
| 38-38.9 | .... | 3.01 | 2.89 | 2.97 | 2.97 | 3.31 | 3.26 | 2.94 | 2.91 |
| 39-39.9 | .... | 3.03 | 2.92 | 2.99 | 2.99 | 3.33 | 3.28 | 2.96 | 2.93 |
| 40-44.9 | .... | 3.05 | 2.95 | 3.01 | 3.01 | 3.35 | 3.30 | 2.98 | 2.95 |

*Cooke, Grayson, Montague.

## Flat Prices

**Louisiana:**
- Sweet Lake ..... $3.00

**Texas:**
- East Texas ..... 3.05-3.25
- Conroe ..... 3.23-3.53
- Van ..... 3.08

**Pennsylvania Grade:**
- Bradford ..... $4.75-4.80
- Middle District ..... 4.52
- Southwest Pennsylvania 4.25
- West Virginia ..... 4.17
- Buckeye Grade ..... 4.08

**Illinois Basin ..... 3.00-3.05**

## Foreign

**Middle East, Persian Gulf: (cargoes f.o.b. lifting port)**
- Arabian, 34.0°-34.9°, Ras Tanura ..... $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur ..... 1.78
- Iranian, 34.0°-34.9°, Abadan ..... 1.73
- Iraq, 35.0°-35.9°, Fao .... 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi ..... 1.59
- Qata, 41.0°-41.9°, Umm Said ..... 1.95

**Middle East, E. Mediterranean:**
- Arabian, 34.0°-34.9°, Sidon ..... $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli .... 2.19

**Far East (cargoes, f.o.b. Lutong, Sarawak):**
- Seria Light, 36° ..... 2.42

**Canada:**
- Leduc-Woodbend ..... $2.53
- Redwater (Alta.) ..... 2.42
- Smiley (Sask.) ..... 2.18
- Pembina ..... 2.38

**Venezuela:**
- Cumbarebo, 47°-47.9°, Tucupido ..... 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz ..... 3.08
- Oficina, 35°-35.9°, Puerto La Cruz ..... 2.80
- Tia Juana medium, 26°-26.9°, Amuay* ..... 2.30
- Quiriquire, 16.0°-16.4°, Caripito ..... 2.10
- Lagunillas heavy, flat, Las Piedras* ..... 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* ..... 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

## Tanker Rates (Long Ton)

(Latest reported spot fixtures)
- Gulf-NY, clean (ATRS −10%) ..... $2.57
- Carib.-NY, dirty (ATRS −55%) ..... 1.24
- ★ PG-UK, dirty (Scale −45%) (32s. 7d.) 4.56
- ★ PG-Japan, dirty (ATRS −62%) ..... 3.72

★ Denotes change from previous week.

# Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

## Gasoline*

**Mid-Continent (Group 3):**
- Regular (91 octane) .. $12.25-12.50
- Premium (99 octane) . 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge ..... 4.0

**Gulf Coast (cargoes for coastwise or export movements):**
- Regular (90 octane) .. 11.00
- Regular (92 octane) .. 11.25
- Premium (98 octane) . 12.25

**California (rack) Los Angeles:**
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) . 12.65-13.15
- Premium (100 octane) 14.00-14.65

**Caribbean area (cargoes):**
- Regular (87 octane) . 10.125-10.25
- Premium (97 octane) . 11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

## Kerosine and Distillate

**Mid-Continent (Group 3):**
- Kerosine 42-44 .... 10.125-10.375
- Diesel oil (58 d.i. and above) ..... 9.75-10.00
- Distillate No. 1 ..... 9.75-10.00
- Distillate No. 2 ..... 8.75- 9.00

**Gulf Coast (cargoes):**
- Kerosine 41-43 ..... 9.00- 9.25
- Distillate No. 2 ..... 8.25

**New York Harbor (barges):**
- ★ Kerosine 41-43 ..... 10.45
- ★ Distillate No. 2 ..... 9.45
- ★ Diesel fuel, 48-52 d.i. 9.65

**Caribbean area (cargoes):**
- Distillate No. 2 ..... 8.125

## Residual Fuel (Bbl.)

**Mid-Continent (Group 3):**
- Residual fuel (max. 1% S) ..... $1.90

**Gulf Coast (cargoes):**
- Bunker C fuel ..... 2.30

**New York Harbor (barges):**
- Bunker C fuel ..... 2.52

**Caribbean (cargoes):**
- Bunker C ..... 2.10

**California (rack):**
- Bunker C fuel, Los Angeles ..... 2.15

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## FOR SALE EQUIPMENT

UNIT-34 Drawworks with Torque Converter and W.A.K. Waukesha Engine. Call Bodard Drilling Company, Phone 7300-1052, Shawnee, Oklahoma.

WELL DRILLS, core drills. Everything for well and core drilling. New and used equipment at money saving prices. Everything in supplies. Nationwide sales. Send for bulletins—Pressey & Son, Pueblo, Colorado.

DE LAVAL 25 million G.P.D. pump complete with 1,000 H.P. steam turbine. Phillips Supply Co., 4802 Roosevelt, San Antonio, Texas.

**PETRO-CHEM ISO-FLOW FURNACES**
**with STAINLESS CONE & TIP**
9MM BTU/HR. Duty; 20' Stack
7MM BTU/HR. Duty; 44' Stack
2MM BTU/HR. Duty; 36' Stack
**HEAT & POWER CO., INC.**
60 East 42nd Street; New York 17, N. Y.
310 Thompson Building; Tulsa 3, Okla.

**NEW 8" LINE PIPE**

32,000' Prime Tested 8⅝" O.D., .188 Wall, 16.89# Electricweld Line Pipe, API 5-L, Grade B, 40' DRL, Beveled. Priced at 12½% saving for prompt shipment loaded cars or trucks Houston.

**WIRE—WRITE—PHONE**

**MID-STATES PIPE AND SUPPLY CO.**
Suite 703 Philtower Bldg., LUther 2-9128
Tulsa 3, Oklahoma

## FOR SALE EQUIPMENT

REBUILT RA-3 Clark Compressor. Advise specifications your requirement: will quote suitably cylindered. Sperbeck Steel, Inc., Box 19351, Houston. Phone: HO-81317.

NATIONAL "XC-P" Emulsion Treater, 8' x 27½', convertible to "IC-P". Has processed only 4,500 bbl. fluid. Jack B. Antry, 1012 Mayo Building, Tulsa 3, Oklahoma.

**LUFKIN 74" STROKE PUMPING UNIT**
228,000# Peak Torque—Single Reduction
6,000' 7" OD Casing, 24# Seamless R-2 10V thd.
5,280' 3" OD 7.57# Beveled Line Pipe
6 & 10 Ton YALE Triplex Spur-Geared Chain Hoists
300 sq. Ft. Steel U-Tube Reboiler
**HEAT & POWER CO., INC.**
310 Thompson Building, Tulsa 3, Okla.

**CASING—TUBING**

| | |
|---|---|
| 3,200' 5½" J55 14# Range, 2 | $1.40 ft. |
| 4,500' 2" Reg. H40 Range, 2 | .40 ft. |
| 1,000' 2" EUE Range, 2 | .50 ft. |

1—8548 36" I.D. 600# Separator like new, ½ new price.
1—OCS 40 H.P. Twin Crank 74" stroke Polly Pumping Unit $3,500.
**R. G. SCOTT—707 Hiway 9 East**
**Seminole, Oklahoma**

**—PIPE—**

| | |
|---|---|
| 2,000,000 ft. 2" | 3.50# to the ft. |
| 1,000,000 ft. 3" | 7.70# |
| 1,000,000 ft. 4" | 10.98# |
| 500,000 ft. 6" | 19.80# |
| 200,000 ft. 85/8" | 28# |
| 400,000 ft. 10¾" | 35# |
| 75,000 ft. 12¾" | 40# |
| 50,000 ft. 18" | 59# |

All No. 1 Grade Plain end and cleaned.
**INDIANA-OHIO PIPE CO.**
**P. O. Box 5412 Shep. Sta.**
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**Phone CL 3-5527**

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- ***TOWERS***
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**Box 5203, Baltimore 24, Maryland**

# FINAL CLEAN-UP SALE
## DESTREHAN, LA.

**HEAT EXCHANGERS**

| | | | | |
|---|---|---|---|---|
| Steel Tube: | 3280, | 2100, | 1200, | 950 sq. ft. |
| Adm. Tube: | 2800, | 2700, | 2600, | 2100, |
| | 1700, | 1500 | 1375, | 1250, |
| | 1100, | 1000, | 920, | 650 sq. ft. |

20 Fin Tubes: 50-190 sq. ft.

**VESSELS & TOWERS**

| | |
|---|---|
| 8' x 75' 20 Tray 25# | 4' x 36' packed 210# |
| 7½' x 56' 20 Tray 35# | 10' x 55' 60# |
| 3' x 58' 30 Tray 134# | 8' x 43' 60# |
| 3' x 47' 20 Tray 120# | 6' x 42' 200# |
| 18" x 32' 15 Tray 130# | 6' x 20' 40# |
| 2' x 30' packed 50# | 12' x 43' 25# |

**PUMPS**
Hot Oil: 1"-6"; 50-400 gpm 100-3,000 ft. hd.
Boiler Feed: 190 gpm 1,500' hd.
Cooling Tower: 7,000 gpm 120' hd.
River Water Sump: 1,000 gpm 59' hd.

**STORAGE TANKS & SPHERES**
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1 Worth LT-6 Compressor

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HELP WANTED

HELP WANTED

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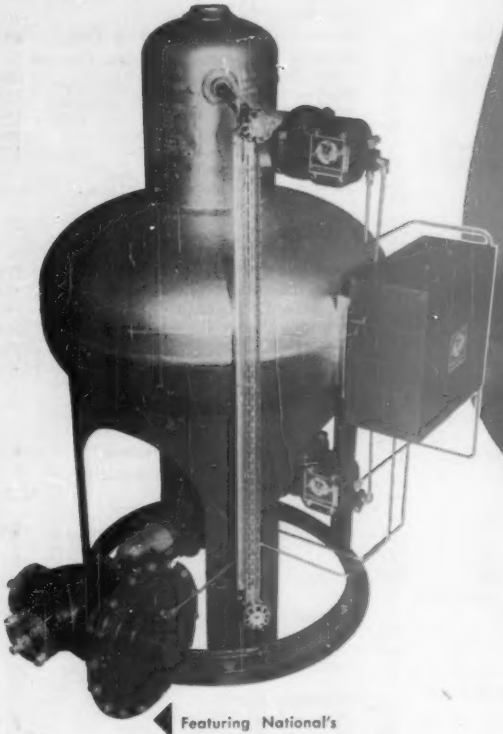

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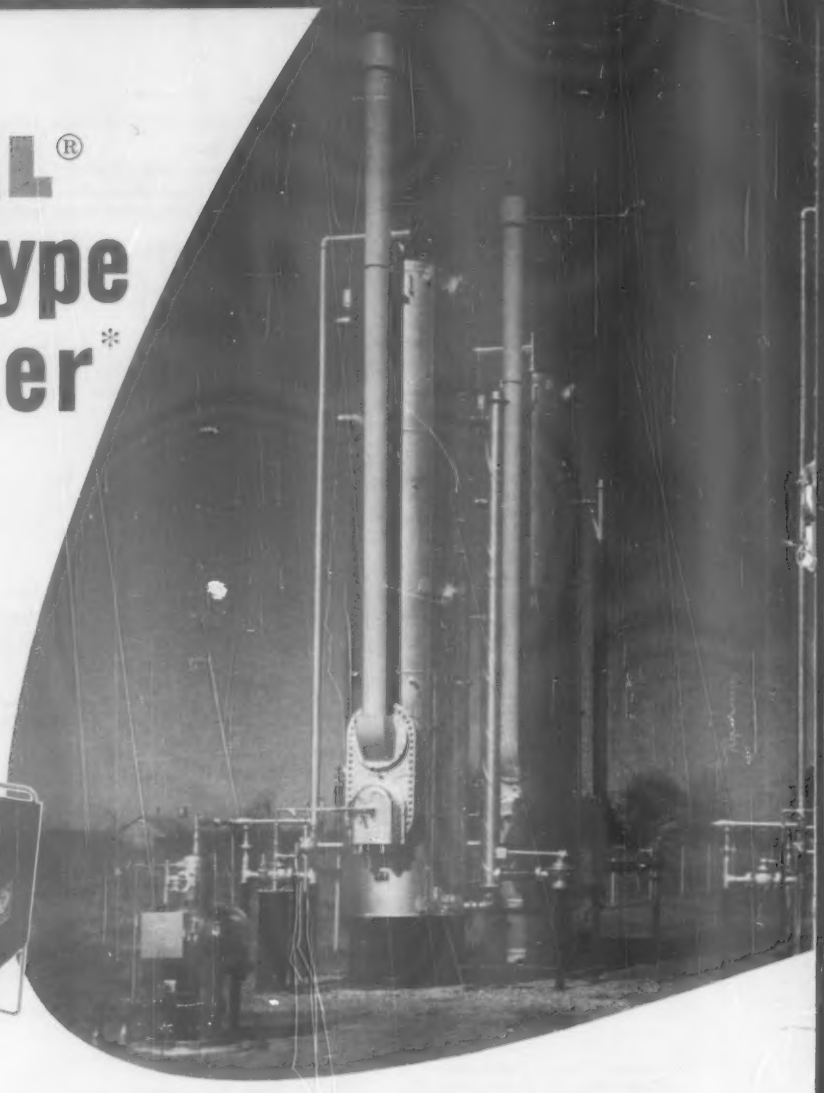

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- **Each meter water-calibrated in the shop to meet the requirements of certain State Commission rules.**
- **Liquid valve internals are completely removable and all stainless steel for longest life.**
- **Reduced liquid surface area for highest meter repeatability.**
- **Greater dependability provided through two sensitive liquid level controls.**
- **Control booster relay in weather-proof, tamper-proof box insures fast, positive liquid valve action.**
- **Corrosion resistant trim in all valves and controls.**
- **All components rust and weather-proofed.**
- **Accurate within the limits prescribed by producer, royalty owner and regulatory body for measuring oil to be commingled.**

*Trademark of National Tank Company

Patent No. 2936622

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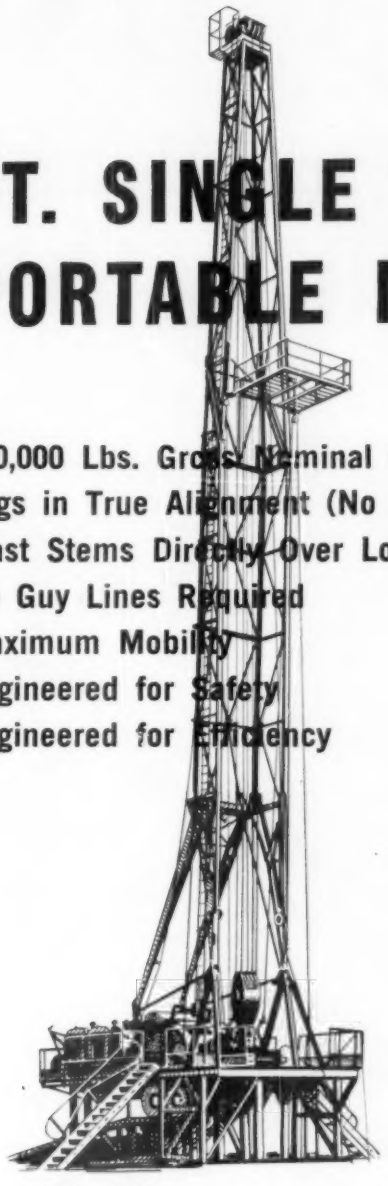
DRAWER 1710

TULSA, OKLAHOMA

# 126 FT. SINGLE TRAILER PORTABLE MAST



**420,000 Lbs. Gross Nominal Capacity**
**Legs in True Alignment (No Overlap)**
**Mast Stems Directly Over Load**
**No Guy Lines Required**
**Maximum Mobility**
**Engineered for Safety**
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These programs are aimed at saving drilling time and bit costs by getting the most out of every bit run, and by making the maximum effective use of the equipment the operator has on hand.

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